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Proposed Wastewater Treatment Plant, Olathe, Kansas

Sverdrup and Parcel and Associates, Inc.
St. Louis, MO

Prepared for

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The Draft Environmental Impact Statement (EIS) evaluated 11 alternatives to build a wastewater treatment plant and interceptor system for that part of Olathe, Kansas that is in the Cedar Creek Basin. Based on a comparative analysis of both monetary and nonmonetary impacts of the alternatives, EPA has identified a preferred alternative project. The preferred alternative consists of staged construction of a 3 MGD wastewater treatment plant with gravity interceptors, two major lift stations and two major force mains. The gravity interceptors are generally aligned with Cedar and Little Cedar Creeks. One major lift station would pump around Ernie Miller Nature Center Park, and the other lift station would pump around Olathe Lake.

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Draft

Proposed Wastewater Treatment Plant Olathe, Kansas

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ENVIRONMENTAL IMPACT STATEMENT

FOR

WASTEWATER TREATMENT FACILITIES

CITY OF OLATHE
JOHNSON COUNTY, KANSAS

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION VII
KANSAS CITY, MISSOURI

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SUMMARY

1. Background

The City of Olathe is the county seat of Johnson County, Kansas, and is one of the most rapidly-growing cities in Kansas. In August, 1976, the City received a grant from the U.S. Environmental Protection Agency to plan sewerage facilities for a 27,000-acre study area that included most of the older part of town, and a large area lying primarily west of the city. The study area encompassed all or parts of the Little Cedar Creek, Mill Creek, and Cedar Creek basins; and about two-thirds of the study area was unincorporated. The purposes of the study were to relieve overloading at the City's Harold Street treatment plant, to prevent wet weather overflows at several lift stations, and to provide sewerage facilities to handle the projected growth of the study area. The resulting Facilities Plan and Supplement to the Facilities Plan proposed to build a 3-mgd treatment plant at the confluence of Cedar and Little Cedar Creeks, which would be fed by a gravity interceptor along Little Cedar Creek and a gravity interceptor-force main combination along Upper Cedar Creek. No work was proposed for the Mill Creek basin.

The proposed interceptor along Little Cedar Creek would pass through Ernie Miller Park, which is maintained as a natural area by the Johnson County Park and Recreation District (JCPRD). JCPRD objected to that alignment, and, during the ensuing controversy, the entire project drew considerable opposition from a significant minority of the residents of the study area who did not believe sewers were needed; did not want to pay for sewers, be annexed by the city or see the study area become urbanized; and who feared that the proposed treatment plant would ruin the ecology of Cedar Creek below the outfall. Therefore, to determine the effects of the proposed project, and to examine alternative solutions to the problems of the study area, EPA has prepared this Environmental Impact Statement. Major issues identified in the Notice of Intent to Prepare an EIS, or during the preparation process, include: 1) impacts to Ernie Miller Park; 2) growth and land use changes; 3) destruction of cultural resources; 4) need for other alternatives; 5) erosion, siltation, flood damage, and sludge disposal; 6) implementability; and 7) impacts on Olathe Lake.

2. Setting

The study area is about 20 miles southwest of Kansas City, Missouri, and its proximity to the Kansas City Metropolitan Region is the primary reason for its present and projected rapid growth rates. It encompasses the entire Little Cedar Creek basin (7,600 acres - 3,900 in the City), all of the Mill Creek basin within the City Limits (3,600 acres), and all the Cedar Creek basin above its confluence with Little Cedar Creek (15,800 acres - 1,600 in the City). The 1980 population of the study area is estimated to be 22,900, with 2,600 in the Upper Cedar Creek basin, 7,400 in the Little Cedar Creek basin, and 12,900 in the Mill Creek basin. About 94% of this population is within the City Limits. Projections for the year 2000 foresee populations of 7,200 in the Upper Cedar Creek basin, 15,400 in the Little Cedar Creek basin, and 20,400 in the Mill Creek basin; a total study area population of 43,000, and an increase of almost 88% in 20 years. Careful examination of the methodology used in making these projections concluded that factors other than provision of sewerage were dominant, i.e., that the population growth would occur whether or not the proposed project was built.

The topography of the planning area exhibits relatively steep gradients, and local relief varies about 370 feet. Bedrock is sedimentary, mostly shale, with some prominent limestone strata and a few sandstones. Soils in the study area are relatively thin, and nearly all are considered unsuitable for use as septic system leach fields. The 303 Plan for the Kansas River Basin has recommended that septic tanks not be allowed in most of Johnson County. There are no extensive groundwater aquifers beneath the study area, and there are only four known wells.

The study area was originally an area of transition between the eastern oak-hickory forest and the big bluestem prairie regions, with a diverse ecology. Most of the original vegetation has been significantly altered by agricultural practices, logging, grazing, and urban development. Wildlife found in the area include small mammals, resident and migratory birds, reptiles, and amphibians, none of which are particularly noteworthy. No endangered or threatened species has been sighted or collected in the area, although their presence is possible. The 113-acre Ernie Miller Park, which contains an outstanding bottomland woodland and several lesser stands of trees, has significant value in its present role as a biological study area; a value that is simultaneously enhanced and threatened by its proximity to the city.

Cedar and Mill Creeks both flow north to the Kansas River, and both are intermittent streams much of the year along nearly all their length within the study area. Little Cedar Creek is a tributary of Cedar Creek, joining it just before it leaves the study area. It is also intermittent much of the year. Water quality in all three streams is generally within established standards, except for low dissolved oxygen levels in the summer. Mill Creek, which receives approximately 3.3 mgd of treated sewage from the Harold Street treatment plant exhibits considerably higher nitrogen and phosphorus concentrations than Cedar Creek. A comparative study of the aquatic ecology of Mill and Cedar Creeks showed a considerably lower species diversity in Mill Creek, with pollution-sensitive species being particularly affected. There are no threatened or endangered species in the waters of the planning area.

More than 23,000 of the study area's 27,000 acres are undeveloped, with the majority of this land devoted to agriculture. Over half of the developed acreage is used for residential developments, primarily in single-family subdivision-type housing units. Population densities per acre of developed land are 7.85 in the Mill Creek basin, 5.74 in the Little Cedar Creek basin, and 1.67 in the Upper Cedar Creek basin. City officials hope to balance the extremely rapid growth that has been occurring east of I-35 (outside the study area) with future development in the study area, primarily to prevent traffic congestion on the east side from becoming worse, and to make provision of community services more efficient. This plan was stalled from April, 1978 to September, 1979 by a de facto State-imposed moratorium on sewer extensions in the study area until the overloading on the Harold Street treatment plant and the problem lift stations was alleviated. Even during the moratorium, pressure for residential development in the study area was so great that several developers built temporary treatment facilities to serve their subdivisions. None of the major highway improvements needed to relieve the traffic congestion are scheduled for construction until after 1990.

Olathe is primarily a "bedroom community," with most of its labor force commuting to Kansas City or Overland Park. However, it does have a substantial economic base of its own, and is continually striving to attract additional commerce and industry. The median household income in Olathe is about $19,471, indicative of a relatively high degree of affluence.

The study area contains numerous cultural resources, including five archaeological sites that may be eligible for inclusion in the National Register of Historic Places, and eight others that may be eligible for inclusion in the Kansas Inventory of Historic Sites. Recreation facilities are generally adequate, and the City's Comprehensive Plan includes provisions for keeping abreast of the area's growth.

The 208 and 303 plans, and all previous long-range wastewater management planning, endorse the concept of separate sewage collection and treatment facilities in the Cedar Creek and Mill Creek basins, with a series of interim plants in each basin eventually giving way to one or two major regional treatment plants in each basin, as development warrants. These regional plants would be operated by the Johnson County Unified Sewer District. The existing Harold Street plant and the proposed plant at the confluence of Cedar and Little Cedar Creeks would be classified as interim plants in this concept.

The Harold Street treatment plant has a design capacity of 2 mgd, and is presently receiving average daily flows near its 3.3 mgd hydraulic capacity, which results in frequent violations of its NPDES permit limitations. Eleven lift stations in the study area pump to this plant, and six of these are frequently overloaded during wet weather.

Four of these problem lift stations that are in the Cedar and Little Cedar Creek basins would be replaced with gravity interceptors under the proposed plan, and their flows diverted to the new plant.

3. Development of Alternatives

The Facilities Plan's approach to the existing pollution problems was to transfer flows from the Upper and Little Cedar Creek basins, that are presently treated at the Harold Street plant, to a new plant in the Cedar Creek watershed. This was intended to restore and maintain the Harold Street plant's adequacy throughout the design period. Five treatment systems were evaluated for the new Cedar Creek plant, and an oxidation ditch process was selected to provide the required secondary treatment.

Nine different interceptor/force main alternatives were investigated to convey sewage to the new plant and facilitate abandonment of the four problem lift stations and three existing temporary treatment facilities in the study area. These nine alternatives differed primarily in the areas of capacity and service area, rather than alignment. Six different definitions of peak flow were used, all of which were based on serving all, or some fraction, of the "ultimate development" of the study area, and all of which exceeded EPA's guidelines for allowable interceptor capacities.

The Facilities Plan's Selected Project consisted of three stages. Stage 1 construction, in 1980, included a 2-mgd treatment plant at the confluence of Cedar and Little Cedar Creeks, and an interceptor sized for 0.01 cfs/acre along Little Cedar Creek. Stage 2 construction, in 1985, included a lift station at the north end of Olathe Lake, a force main along Cedar Creek north of the lake, and an interceptor sized for 0.01 cfs/acre around the west side of the lake. Stage 3 construction, in 1990, included a 1 mgd addition to the treatment plant, additional capacity for the lift station, and an interceptor sized for 0.005 cfs/acre along Cedar Creek south of Olathe Lake. This project had a present worth, in 1979 dollars, of $12,680,000, including operating and maintenance costs, and was the second most expensive of the nine Facilities Plan alternatives.

EPA may deny additional grant funding (the "No-Action" Alternative) if there is no need for the project, or if the No-Action Alternative is the most environmentally sound. The need for a project is well established. To determine the environmental soundness of denying grant funding, several options available to the City were examined. A No-Action Alternative that assumed that the City would perform the minimum amount of construction necessary to comply with the terms of its NPDES permit, and would encourage developers to construct their own individual treatment facilities, was considered the most likely to be adopted.

None of the alternatives developed by the Facilities Plan proposed any work in the Mill Creek basin. Therefore, two additional alternatives were developed for comparison. One of these was to expand the Harold Street plant, and continue pumping all wastewater generated in the Cedar and Little Cedar Creek basins to that plant for treatment. The other was to abandon the Harold Street plant, expand the Johnson County Unified Sewer District's (USD) Mill Creek plant, and convey all wastewater from the study area to the Mill Creek plant through an interceptor constructed along Mill Creek. The present worth of either of these projects exceeded that of any of the Facilities Plan alternatives.

4. Evaluation of Alternatives

Several problems were encountered in trying to compare the various alternatives. In addition to having different interceptor capacities and service areas, it was determined that none of the nine Facilities Plan alternatives included all the work necessary to meet the stated goal of restoring and maintaining adequate treatment at the Harold Street plant throughout the design period. The major items missing were the replacement of worn-out equipment at the Harold Street plant, and the cost of transferring flows from Sewer Districts 7 and 13a to the USD's Mill Creek plant. This latter work is particularly important, since the new plant on Cedar Creek initially will remove the flow from a population equivalent of only about 5-7,000 from the Harold Street plant, while the population increase for the Mill Creek basin during the design period will be more than 10,000. Therefore, if the Districts 7 and 13a flows are not transferred, the Harold Street plant will become even more overloaded than it now is.

Cost estimates were made for the missing work elements, and the present worth of all eleven alternatives was adjusted to include the missing costs. After adjustment, the present worth of the 201's Selected Project was $19,454,000, and it was still the eighth most cost-effective of the eleven alternatives. Facilities Plan alternatives III-B and II-B were the most cost-effective, with adjusted present worths of $16,934,000 and $17,274,000, respectively.

The impacts of all the Facilities Plan's projects would be quite similar, because they all propose the same treatment plant and nearly identical interceptor/force main alignments. Therefore, only the 201's Selected Project, the No-Action Alternative, the two most cost-effective projects (Alternatives III-B and II-B), and the most cost-effective of the EIS-developed alternatives (expanding the Harold Street plant) were selected for further evaluation. The impacts of the 201's Selected Project were assessed in detail; those of the other alternatives were developed by comparison with those of the 201's Selected Project, primarily in the areas related to the major issues of the EIS.

All alternatives except the No-Action Alternative would result in severe loss of aesthetic values in Ernie Miller Park, caused by the deforestation of a 105-foot wide strip along the sewer easement through the park. This would also significantly affect the use of the park as a nature-study facility. Similarly, except for No-Action, all alternatives would cause major loss of vegetative cover along the steep west bank of Olathe Lake, with resultant major erosion and siltation problems.

The three Facilities Plan projects evaluated would all have a major detrimental effect on the existing water quality and aquatic ecology of Cedar Creek below the outfall, because discharging up to 3-mgd of secondary treated wastewater would lower existing dissolved oxygen concentrations, and would increase existing suspended solids concentrations. Chlorine residuals in the effluent would also adversely affect sensitive aquatic life. However, the effluent would meet present water quality criteria. There would be no noticeable balancing improvements in the water quality or aquatic ecology of Mill Creek from constructing any of these three projects.

The No-Action Alternative would discharge almost the same total amount of sewage into Cedar Creek as the Facilities Plan alternatives, but would do so by releasing small quantities at many places within the study area. Although localized impacts immediately below a given outfall would be similar to those of the above three projects, and would be worse if discharging lagoons were used, their extent would be much less. The total impact would probably be less noticeable because of the small areas affected and the wide distribution of the discharges.

The alternative of expanding the Harold Street plant would avoid impacts to Cedar Creek's water quality at the expense of a slight further deterioration in the Mill Creek. This is judged a net benefit, because of the presently poor condition of Mill Creek and the relatively unspoiled nature of Cedar Creek.

None of the alternatives would require relocation of businesses or individuals, nor would any retire a significant amount of land through direct acquisition for sites and rights-of-way. Since it was determined that the projected population influx will occur with or without centralized sewerage facilities, and all the alternatives are staged to follow population growth, none will cause any significant inducement of uncontrolled growth. However, the interceptors of the three Facilities Plan projects and the alternative to expand the Harold Street plant do have considerable excess capacity, and could induce growth were it not for the limitations imposed by their pumping station and treatment plant capacities. This excess capacity also results in a significant waste of financial resources. The No-Action Alternative would have the secondary effect of requiring much more land for residential housing than any of the centralized systems because of the lower population densities it would encourage.

The most cost-effective alternative, Alternative III-B, has a major drawback in that it would not allow service to be provided to large parts of the study area, some of which are already being developed. From the standpoint of promoting orderly growth, Alternative II-B is considerably superior to any of the others.

All of the Facilities Plan alternatives have significant potential for disrupting important archaeological sites in the Upper Cedar basin and at the treatment plant site. This is a major impact; however, it will be relatively easy to avoid the sites. The No-Action Alternative and the alternative to expand the Harold Street plant are much less likely to affect archaeological resources.

Of the alternatives considered, only Alternative II-B and the No-Action Alternative would provide sewerage service to the entire project area, and the latter would require development of an entirely new approach to wastewater management and a reversal of current State policies against proliferation of small treatment works. All except the expansion alternative would require inclusion of additional project elements to ensure maintaining adequate treatment at the Harold Street plant throughout the design period.

Except for the No-Action Alternative, all the alternatives will probably encounter significant opposition from a vocal, significant minority of study area residents. Alternative III-B will likely be opposed by the State because of its failure to serve presently-developed areas. The 201's Selected Project and the alternative of expanding the Harold Street plant will probably meet State and Federal opposition because they are not cost-effective.

5. Mitigative Measures, Requirements, and Recommendations

EPA regulations [40 CFR 35.917(b)] require that the project selected be the most cost-effective alternative that meets established water quality goals, while recognizing environmental and social considerations. Therefore, EPA intends to require, as a condition of further grant funding, that Facilities Plan Alternative II-B be made the selected project. EPA further intends to require that: 1) the City bear the entire cost of any interceptor or holding basin capacity proposed beyond that calculated in accordance with EPA criteria; 2) the work elements necessary to ensure continued adequacy of the Harold Street plant be included in the project; 3) the project be modified to incorporate lift stations at the south ends of Olathe Lake and Ernie Miller Park that will pump around them to continuations of the gravity interceptors on their north sides; 4) a letter from the SHPO be submitted before award of the Step 2 grant giving conditional approval, and that a second letter be submitted before award of the Step 3 grant indicating final approval, of all pipe routings and facility sites; and 6) several items be included in the construction specifications to ensure mitigation of various lesser impacts.

EPA also recommends, among other suggestions, that the City and County governments immediately begin negotiations to resolve the questions of how the benefit districts in the project area will be established and how the capital costs of the project will be assessed. These negotiations should be made with maximum public participation, and the final agreement should be widely publicized within the project area.

6. Public Participation and Coordination

The first major opportunity for public participation was at the formal hearing on the Facilities Plan, December 14, 1976. Six persons asked questions about various aspects of the project, but seldom received direct answers because the City Commission had not yet reviewed the report, nor made any decisions concerning its recommendations. No particular support for, or opposition to, the project was voiced at the hearing.

Shortly after the hearing, considerable controversy appeared, primarily over the impacts to Ernie Miller Park, the possibility of induced growth, and annexation by the City, which was seen as a corollary to building the project. This controversy led to EPA's decision to prepare this EIS.

The only other meeting specifically devoted to the proposed project was an EPA-sponsored public workshop, held January 10, 1979. This meeting was attended by about 50 persons, about 25 of whom were private citizens residing in the study area. Opinions expressed during the discussion period, which followed a presentation on the project and the EIS process, were about evenly divided, for and against the project. Since that time, EPA and EIS preparation team personnel have had numerous contacts with local residents and public officials.

A formal public hearing on this Draft EIS will be held approximately 30 days after publication of the notice of its availability.

GLOSSARY

Act, the - the 1977 Clean Water Act, PL 95-217.

Aerobic - requiring the presence of free elemental oxygen.

Anaerobic - requiring the absence of free elemental oxygen.

Aquifer - an underground, water-bearing stratum of permeable rock, sand, or gravel.

Alluvial - relating to material deposited by a stream.

Avian - relating to birds.

Benthos - organisms dwelling on the bottom of a water body. Benthos include all organisms which crawl on, burrow into, or grow attached to, the bottom.

Biochemical oxygen demand (BOD) - the quantity of oxygen used in the biochemical decompositon of organic matter; used to indicate the amount of organic matter present in water; BOD_5 refers to a biochemical oxygen demand reading taken from a test in which a water sample is incubated with bacteria for 5 days.

Biota - the plants and animals of an area, taken collectively.

BOR - U.S. Dept. of the Interior, Bureau of Outdoor Recreation, now the Heritage Conservation and Recreation Service.

Carbon monoxide - odorless, toxic gas contributing to air pollution, released mainly by motor vehicles.

cfs - cubic feet per second.

Chemical oxygen demand (COD) - a measure of the oxygen-consuming capacity of inorganic and organic matter present in water or wastewater.

Chlorination - disinfection of water by treatment with chlorine.

Clean Water Act - federal law passed in 1977 revising Federal Water Pollution Control Act Amendments of 1972; pertinent sections are 201, 208, and 303 (e).

Cohort-survival method - a method of projecting populations based on birth and death rates and migration patterns.

Coliform - a group of bacteria which includes organisms found on plants, in soils, and in human and animal feces; their presence is used as an indicator of water pollution.

Colluvial - pertaining to a loose, heterogeneous, incoherent mass of soil material or rock fragments deposited by mass-wasting; usually at the bottom of a cliff or steep slope.

Complete-mix activated sludge system - a biological wastewater treatment process in which a mixture of wastewater and bacteria is agitated and mechanically aerated, allowing bacterial decomposition of waste solids; bacteria and remaining solids are subsequently separated from the treated wastewater by settling, and wasted or returned to the process as needed.

Construction Grants program - a program administered by EPA to carry out the mandate of the Clean Water Act to assist local communities in funding municipal wastewater facilities.

Deciduous forest - an association of trees that shed their foliage at the end of a growing season.

Design flow - the volume of wastewater a facility is expected to process in a given length of time; usually the average daily amount of wastewater expected to be produced in a facility's service area 20 years after its construction.

Dip - the angle that a structural geologic surface makes with the horizontal, measured perpendicular to the line formed by the intersection of the surface with the horizontal.

Diurnal - occurring every day

DO - dissolved oxygen

Ecosystem - a system formed by the interaction of a group of organisms and their environment.

Effluent - wastewater discharged from a facility or one of its components.

EIS - Environmental Impact Statement.

EPA - U. S. Environmental Protection Agency.

Escarpment - a long, continous cliff or steep slope facing in one general direction.

Eutrophication - the process of maturation of a lake from nutrient-poor to nutrient-rich. The artificial addition of nutrients to lakes accelerates the process.

Extended aeration - a complete-mix activiated sludge system in which the amount of influent wastes is relatively small compared to the amount of bacteria in the system, requiring longer detention times than conventional complete-mix activated sludge processes and resulting in less sludge wastes.

Extraneous Flow Basins - lagoonlike structures designed to retain flow above the capacity of a facility during periods of high flow, and feed it back to the facility during periods of lower flows.

Facilities Plan - a preliminary engineering report on proposed wastewater treatment facilities; developed to fulfill Step 1 requirements of EPA's Construction Grants program; analyzes treatment needs, alternative treatment methods, existing sewer system adequacy, and costs; includes an environmental assessment; also referred to as a "201 plan."

Fauna - the animal life of an area.

Fecal coliform - group of bacteria present in human and other warm-blooded animal intestines and excreted in feces; while harmless in themselves, fecal coliforms may indicate the presence of pathogens.

Flood plain - the land adjacent to a river channel which is covered with water when the river overflows its banks.

Flora - the plant life of an area.

Forbs - herbaceous plants other than grasses, sedges, and reeds.

Force main - a sewer through which wastewater is pumped.

fps - feet per second

FWPCA - The Federal Water Pollution Control Act

FWS - U.S. Dept. of the Interior, Fish and Wildlife Service

Genus (plural-genera) - group of related animals or plants ranking below a family and above a species.

gpcd - gallons per capita per day.

gpd - gallons per day

gpm - gallons per minute

Gravity sewer - a sewer in which the wastewater flows downhill from source to outlet, with no pumping required.

Grit removal - initial phase of primary treatment in which large solids - generally inorganic ones - are removed.

Habitat - the place where an organism lives.

HCRS - U.S. Dept. of the Interior, Heritage Conservation and Recreation Service.

Herbaceous - pertaining to plants with stems that are soft, and not woody.

I/I - the combined extraneous wastewater flow from infiltration and inflow.

Infiltration - (1) movement of water downward into the soil; (2) water entering a sewer system underground by such means as cracks in sewer pipes and manholes and leaky pipe joints, usually caused by a water table above the level of the sewer.

Inflow - water other than sewage entering a sewer system directly by such means as connections with storm sewers, roof and foundation drains, sump pumps, and holes in manhole covers.

Influent - wastewater entering a wastewater facility or component thereof.

Interceptor sewer - a sewer receiving flows from collector lines and carrying them to a central point for treatment and discharge.

Intermittent stream - a stream or a reach of a stream that flows only at certain times of the year.

JCPRD - Johnson County Park and Recreation District

KDHE - Kansas Department of Health and Environment

Lagoon - a large pond in which wastewater is retained for primary and/or secondary treatment; discharging lagoons produce an effluent, which according to Kansas law must contain no more than 30 mg/l BOD_5 and 80 mg/l suspended solids; non-discharging lagoons rely on evaporation for disposal of water.

Land treatment - wastewater treatment by the action of bacteria present in the soil following its application onto the surface of the ground; accomplished by overland flow, rapid infiltration, or slow infiltration; in Kansas, land application must be preceded by 90 days' storage.

Lift station - a wastewater pumping station that lifts wastewater to a higher elevation when the continuance of the gravity sewer at reasonable slopes would involve excessive depths of trench.

Limestone - a carbonate sedimentary rock containing more than 95% calcite and less than 5% dolomite.

Loess - a shallowly buried layer of windblown dust of relatively recent geologic age; generally nonstratified, porous, unconsolidated and fine-grained, consisting predominantly of silt.

Macrophytes - aquatic plants possessing a multi-cellular structure with cells differentiated into specialized tissues. Their sizes range from near microscopic, e.g., duckweed, to massive cypress trees. Macrophytes can be divided into three major growth types: floating, submerged, or emersed.

Macroscopic - large enough to be perceived or examined by the unaided eye.

Mass-wasting - a general term for the dislodgement and downslope transport of soil and rock.

mgd - million gallons per day

mg/l - miligrams per liter; approximately equivalent to parts per million.

msl - mean sea level

Mitigating measure - action taken to lessen or eliminate an adverse environmental impact.

Mixing zone - that portion of a stream from the point at which effluent is introduced downstream to the point at which it is uniformly mixed with the receiving waters.

NEPA - National Environmental Policy Act of 1969.

Nitrogen dioxide - toxic, corrosive, reddish-orange gas released into the atmosphere mainly through combustion of natural gas and coal and exhaust from motor vehicles.

Non-point-source discharge - general source of pollution not originating from a single controllable source, e.g., runoff from farmland.

Notice of Intent - announcement by a Federal agency of its intent to prepare an EIS.

NPDES - National Pollutant Discharge Elimination System.

Oxidation ditch - method of sewage treatment using a ring-shaped channel, about 3 ft. deep, and a rotor to provide circulation and aeration.

Package plant - a small wastewater treatment plant whose various components are contained within one structure, purchased and installed as a unit.

Particulates - minute, separate particles dispersed in the air, contributing to pollution; main sources are coal combustion, industrial processes, and forest fires.

Pathogen - disease-producing organism.

Percolation - movement of water through soil; empirically measured by a test in which a hole is drilled in the soil and soaked, then filled with water, and the rate of downward movement of the water surface recorded, given in minutes per inch; does not necessarily correllate directly to permeability.

Perennial stream - a stream or a reach of a stream that flows continuously throughout the year.

Permeability - quality of soil that permits it to transmit water; empirically measured by rate of downward movement of water through saturated soil cores; given in inches per hour; does not necessarily correllate directly to percolation.

Physiographic province - any large geologic area or region considered as a whole, all parts of which are characterized by similar landform features or history, and differ significantly from those of adjacent areas.

Planning area - area covered by a Facilities Plan.

ppm - parts per million; approximately equivalent to milligrams per liter.

Point-source discharge - introduction of treated or untreated wastewater into a body of water at a discrete point of discharge, such as a pipe.

Primary impact - direct effect of an action.

Primary treatment - the first major process in most wastewater treatment plants; consisting of retaining wastewater in a tank long enough for solids to settle.

Prime agricultural land - land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and which is available for one of these uses; rated in Class I or II in SCS's agricultural capability classification system.

Province - an area that corresponds to a broad vegetation region, and which has uniform regional climate and the same type or types of zonal soils.

Range - land producing naturalized or native forage for animal consumption, and lands that are revegetated naturally or artificially to provide a forage cover that is managed like naturalized or native vegetation.

Riparian woodland - an area of trees and other woody vegetation bordering a stream or lake.

Sandstone - a medium-grained sedimentary rock composed of sand-sized particles which are united by a cementing material.

SCS - Soil Conservation Service, a branch of the U.S. Department of Agriculture.

Secondary impact - an indirect effect of an action; for example, population growth induced by the existence of a facility.

Secondary treatment - removal of organic wastewater constituents, usually by microbial activity, following primary treatment (settling); a plant is recognized as providing secondary treatment if its effluent contains no more than 30 mg/l each of BOD_5 and suspended solids, or if at least 85% of BOD_5 and suspended solids are removed from the effluent, whichever is the stricter standard.

Section 201 - portion of Clean Water Act providing for federal assistance in the construction of municipal wastewater facilities.

Section 208 - portion of Clean Water Act requiring, and providing for federal assistance in, water quality management planning for counties or multiple-county areas; 208 plans are used to guide all county water pollution control efforts in accordance with federal, state, and local requirements.

Section 303(e) - section of Clean Water Act mandating continuous statewide water quality planning; 303 plans generally encompass entire major river basins, and identify general areas of water quality standards violations.

Sedimentation basin - a basin or tank in which wastewater is retained to allow suspended matter to settle.

Septic tank - a component for partial on-site treatment of wastewater, usually for individual residences, by means of settling and decomposition by anaerobic microorganisms; must be paired with an absorption field for complete treatment.

Septic tank system - wastewater treatment system consisting of a septic tank and absorption field.

Service area - area intended to be served by a given wastewater facility.

Shale - a fine-grained sedimentary rock formed by the consolidation of clay, silt, or mud, and characterized by a finely stratified structure.

SHPO - State Historic Preservation Officer

Siltation - the accumulation by deposition of silt in a body of water.

Sludge - accumulated solids separated from liquids, such as water or wastewater, during treatment or processing.

Species - any group of fish, wildlife or plants which interbreeds when mature.

Species diversity - the number of different species occurring in some location or under some condition.

Step 1 - first stage of a project funded under EPA's Construction Grants program: development of a Facilities Plan.

Step 2 - second stage of a project funded under EPA's Construction Grants program: development of design drawings and specifications.

Step 3 - third stage of a project funded under EPA's Construction Grants program: construction.

STP - Sewage Treatment Plant

Stratum (plural, strata) - a sedimentary bed or layer, visually separable from other layers.

Suspended solids (SS) - particles dispersed within, but not dissolved in, wastewater; if water is allowed to stand, suspended matter will eventually float to the top or settle to the bottom; dissolved matter (for instance, table salt or sugar) will not.

Taxa (plural of taxon) - a group of organisms constituting one of the categories or formal units in taxonomic classification, such as phylum, order, family, genus, or species, and characterized by attributes in varying degrees of distinction.

Trickling Filter - A sewage treatment system in which wastewater is passed through a media bed, usually rocks, for removal of organics by bacteria growing on the media.

Turbidity - cloudiness of water brought about by the presence of silt or other suspended solids.

TSS - total suspended solids, see "suspended solids."

Upland forest - a plant community consisting predominantly of trees and other woody vegetation, found in the higher parts of a region or tract of land.

Uplift - a structurally high area produced by positive movements that raise or upthrust rocks, as in a dome.

USDA - United States Department of Agriculture.

USGS - United States Geological Survey, Dept. of the Interior

CHAPTER I INTRODUCTION

This environmental impact statement (EIS) was prepared in response to the mandate of the National Environmental Policy Act of 1969 (NEPA, or Public Law 91-190). NEPA requires Federal agencies to prepare environmental impact statements on major Federal actions that may significantly affect the quality of the human environment. Section 511 of PL 95-217, the Federal Water Pollution Control Act Amendments of 1977 (as amended), states that providing grant assistance to construct publicly-owned wastewater treatment facilities under Section 201 of the same act can constitute such a major Federal action.

A. PURPOSE OF THE EIS

An EIS is basically a means of providing concise, factual information for use in the Federal decision-making process. In this case, the decision concerns the Federal action of the U.S. Environmental Protection Agency (EPA) partially funding a proposed sewerage project for the City of Olathe, Kansas. This EIS reports the pertinent findings of a thorough, multi-disciplinary investigation of that action, its potential effects on the natural and man-made environment, measures that could be taken to reduce its adverse effects, and possible alternative actions.

This EIS is intended to furnish enough information to allow the responsible officials to weigh the benefits and liabilities of the proposed action and to make an accurate decision regarding its overall value. However, in keeping with current Council on Environmental Quality regulations (1)*, it includes primarily that information relevant to the issues causing its preparation, and focuses attention upon the areas of major concern. A lack of data regarding a specific subject does not, therefore, indicate a lack of investigation in that area, but rather that the investigation revealed no significant relationship between that subject and the proposed action. To further reduce the size of the EIS, and to improve its comprehensibility, much data has been incorporated by reference only, with sources given in the List of References. All source documentation is available from EPA for review upon request.

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* Numbers in parentheses correspond to entries in the List of References.

B. BACKGROUND AND SUMMARY OF FACILITIES PLAN

1. Background

The City of Olathe, Kansas, is in central Johnson County, about 20 miles southwest of downtown Kansas City, Missouri (see Figure 1). It is the county seat, and takes considerable civic pride in the fact that it is the only city in Johnson County that offers its citizens a full range of municipal services.

The City's population has grown steadily from 5,593 in 1950 to an estimated 27,932 in 1978 (2, 3). Although Olathe has its own economic base, a significant fraction of its residents commute to jobs in other parts of the Kansas City Metropolitan Region (KCMR). Because of the "small-town" amenities Olathe offers, its own expanding economy, and its accessibility to the KCMR, rapid growth is expected to continue until at least the year 2000. The difficulty of keeping municipal services, specifically sewage collection and treatment, abreast of this rapid growth created the problems leading to the proposed project.

In July, 1975, the City applied to EPA for Federal grant funding assistance to prepare a Facilities Plan (201 plan) for wastewater collection and treatment facilities to serve a study area on the west side of town. This Step 1 grant application was accompanied by the required "plan of study" which defined the boundaries of the study area, outlined the work needed to prepare the 201 plan, and explained why a study was needed.

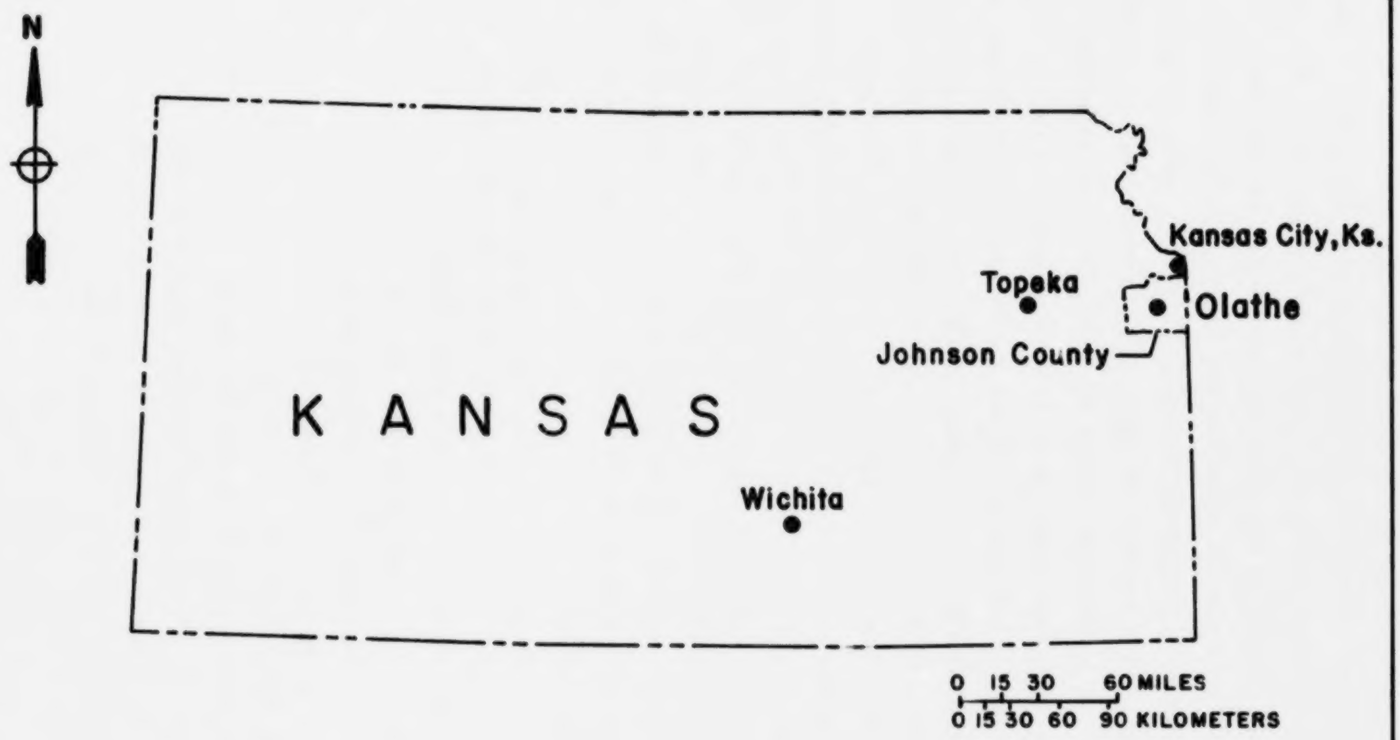

N
KANSAS
Kansas City, Ks.
Topeka
Olathe
Johnson County
Wichita
0 15 30 60 MILES
0 15 30 60 90 KILOMETERS

FIGURE 1
LOCATION MAP

The study area was defined as all of the Cedar and Little Cedar Creek watersheds above their confluence, plus the part of the Mill Creek watershed within the city limits (see Figure 2). The work elements included reviewing the existing facilities in the study area, conducting an I/I analysis of the existing sewers in the study area, developing alternative methods to provide collection and treatment facilities in the Cedar and Little Cedar Creek watersheds, recommending improvements to the collection system in the Mill Creek watershed, and preparing an environmental assessment of the recommended facilities.

The need for the project given in the plan of study was that there had been considerable development in the Little Cedar Creek and Upper Cedar Creek basins, but that few sewers, and no treatment facilities, had been constructed in either basin (except for one small package plant and Delco-Remy's industrial waste pretreatment facility). It was noted that projections indicated that the Mill Creek basin's population would increase from 9,173 to 15,821 by the year 2000 and that the combined population of the Cedar and Little Cedar Creek basins would increase from 6,649 to 22,646 during the same period. The plan of study also stated an intent to use data from two previous studies (4, 5) in the 201 plan.

After review and approval of the plan of study, a Step 1 grant was offered and accepted in August, 1976. The Facilities Plan was completed in November, 1976, and a final draft was submitted to the City for approval. A public hearing on the plan was held December 14, 1976. No significant objections to the project were raised at the public hearing, so copies of the final draft report were forwarded to the State and EPA for concurrent review and approval.

The Johnson County Park and Recreation District (JCPRD) notified the City, by letter dated December 21, 1976, that it was opposed to part of the proposed project; specifically, the interceptor sewer proposed along Little Cedar Creek through Ernie Miller Park,

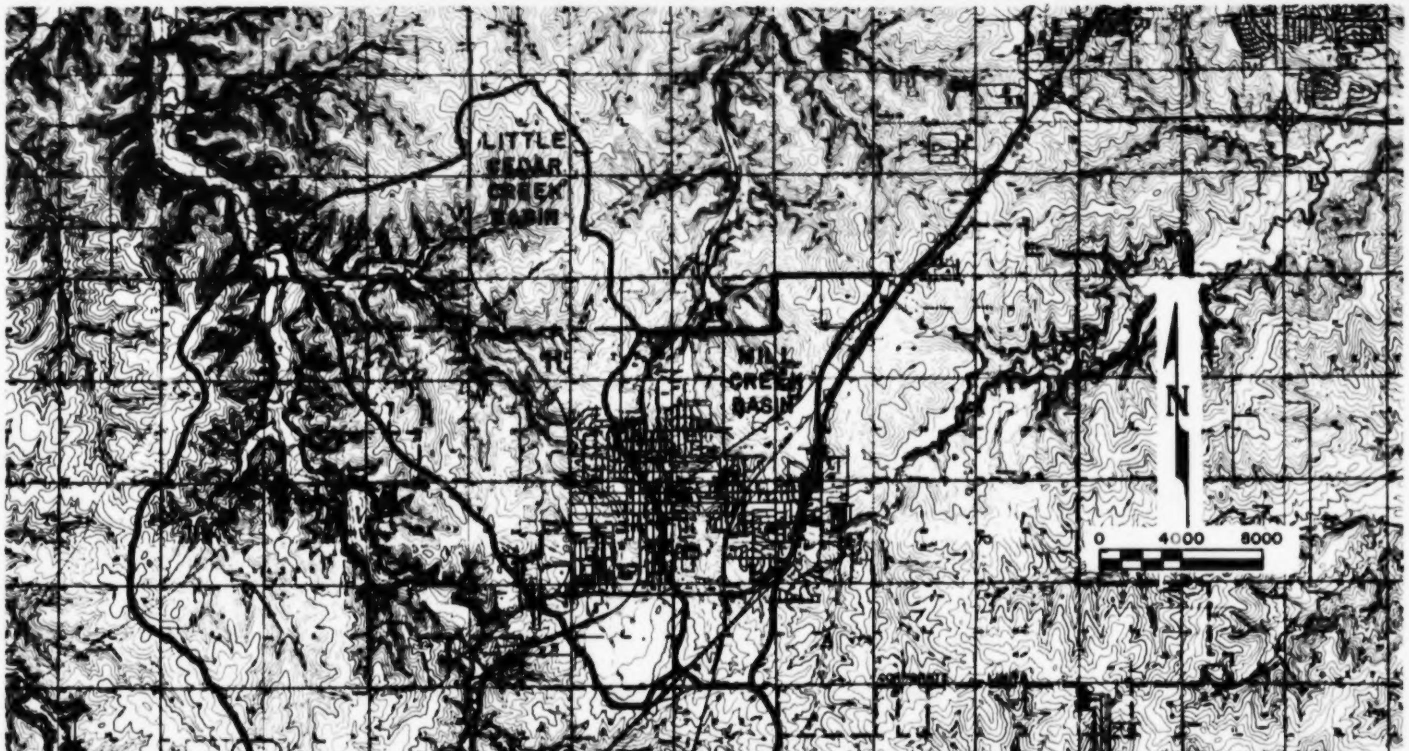

LITTLE CEDAR CREEK BASIN
MILL CREEK BASIN
UPPER CEDAR CREEK BASIN
N
0
4000
8000

FIGURE 2
STUDY AREA BOUNDARIES

SOURCE REF (9)

which JCPRD maintains as a natural area. The park was purchased, in part, with Federal funds which carried a condition that the use of lands purchased with such funds may not be changed from outdoor recreation without receiving approval from the Secretary of the Interior and replacing the affected land with an equal amount of comparable land. Receiving support from both the Department of Interior, Bureau of Outdoor Recreation (BOR, now the Heritage Conservation and Recreation Service, HCRS), and the Kansas State Park and Resources Authority, JCPRD formalized its objections in a letter to the City dated January 13, 1977.

The final version of the Facilities Plan was submitted to the City in February, 1977, and was also sent to the State and EPA for approval. This report was essentially identical to the final draft version, except that it included the public hearing record, copies of written comments received, and a new appendix that presented a cost analysis of two alternatives (tunneling, and pumping around the park) to constructing the contested section of interceptor sewer through Ernie Miller Park. Since the estimated present worth of either alternative was more than three times that of building the sewer through the park, the report's recommendations remained the same.

During the ensuing 17 months, many meetings were held and much correspondence was exchanged concerning the project. State and EPA review comments on the Facilities Plan were received by the City, and responses made. The City and JCPRD negotiated an easement agreement for the interceptor through Ernie Miller Park, routed along a long-abandoned railroad bed, but the agreement's terms were not considered sufficient by HCRS. Numerous editorials and letters-to-the-editor appeared in local newspapers, both for and against the project. Because of the controversy surrounding the project, and the potential adverse environmental impacts upon Ernie Miller Park and the rest of the study area, EPA decided to prepare an EIS. The Notice of Intent to Prepare an EIS (see Appendix A-1) was published July 28, 1978.

Since that date, the Facilities Plan has not been approved by either the State or EPA, and no action has been taken toward offering a Step 2 grant for preparation of contract drawings and specifications. The action taken will depend upon the findings of this investigation.

2. Facilities Plan Summary

The Facilities Plan gives as the reasons for the study the frequent surcharging and overflow of manholes during heavy rains, the need to supplement the 2-mgd design capacity of the Harold Street treatment plant (in the Mill Creek basin) to handle the projected growth of the study area, and the need to provide a sewer system to allow development of the study area. Raw sewage bypasses at several lift stations during wet weather are also cited.

The principal problem is the need to supplement the Harold Street plant, which presently receives an average daily dry weather flow greater than its nominal design capacity. Wet weather peak flows, estimated during the I/I study at about 10.6 mgd, aggravate this overloading, and also cause lift station bypasses. A sewer system evaluation survey (SSES) is currently being conducted to precisely locate inflow sources and better determine the exact cost of eliminating them.

Population estimates used in the Facilities Plan were based on 1971 projections, updated in 1975, prepared by the Mid-America Regional Council (MARC). These estimates showed a 1970 study area population of 16,689, of which 10,040 were in the Mill Creek basin, 5,540 in the Little Cedar Creek basin, and only 1,109 in the Upper Cedar Creek basin. They also gave the total projected study area population in the year 2000 as 43,000, with 20,400 in the Mill Creek basin, and 15,400 and 7,200 in the Little Cedar and Upper Cedar Creek basins, respectively.

The Facilities Plan investigated two sets of four alternative projects each. The two sets were identical except for the interceptor sizing, which varied because each set used a different definition of wet weather peak flow. All alternatives included constructing a "package" treatment plant in phases, with a 1.5 mgd plant being built initially, and a parallel 1.5 mgd plant following about 1990. All plans also proposed constructing short gravity sewers to allow abandonment of the Leeview Estates treatment plant and the Younts, Prairie Center, and Provence lift stations, and a gravity line to relieve a 15" sewer extending southeast from the K-7 lift station.

Plan I in each set proposed gravity interceptors following Upper and Little Cedar Creeks to a treatment plant at their confluence. The interceptors were sized for the wet weather peak flow generated by the ultimate development in their contributing watersheds. Plan II in each set was the same as Plan I, except that the interceptors were sized for only half of the wet weather peak flow. This capacity was deemed adequate until after the year 2000, at which time parallel interceptors could be built. Plan III in each set proposed a gravity interceptor along Little Cedar Creek to the north city limits, a gravity interceptor along Upper Cedar Creek to the north end of Olathe Lake, and pumping stations at those points to convey the sewage through force mains following the two creekbeds to a plant at their confluence. The gravity interceptors were sized for half of the wet weather peak flow, and the pumping stations were to be expanded in 1990. Plan IV in each set proposed gravity interceptors identical to those in Plan III. However, this plan called for constructing the initial treatment plant on Little Cedar Creek at the north city limits, and pumping the wastewater from the Upper Cedar basin to that location. It also called for relocating the treatment plant to the confluence of the two creeks, expanding it to 3 mgd, extending the gravity interceptor along Little Cedar Creek to the relocated plant, and expanding the pumping station at the north end of Olathe Lake in 1990.

Other than removing the wastewater presently being pumped to the Harold Street plant by the four lift stations mentioned above, no improvements were proposed for the Mill Creek basin. The Facilities Plan stated that removing the contributions from the Cedar and Little Cedar basins would give the Harold Street plant adequate capacity to handle the flow received from its 2,000-acre gravity service area throughout the design period.

Plan IV-B was the project recommended by the Facilities Plan. This plan used the lower definition of peak flow, sized the interceptors for the wet weather peak flow generated by half the ultimate development of the watersheds, and incorporated the Phase I treatment plant on Little Cedar Creek, with the plant being relocated to the confluence of Cedar and Little Cedar Creeks about 1990.

3. Facilities Plan Supplement

During the extended Facilities Plan review period, development occurred in parts of the study area that would not be served by the gravity interceptors proposed for initial construction. In recognition of this problem, the Kansas Department of Health and Environment (KDHE) requested that the City modify the proposed project by constructing the initial treatment plant at the confluence of Cedar and Little Cedar Creeks, rather than on Little Cedar Creek at the northern city limit. In response to that request, and to other review comments received from KDHE and EPA, the City submitted a supplement to the Facilities Plan in June, 1979. The supplement included an analysis of alternate treatment methods, a revision and updating to March, 1979 of the present worth costs of the eight Facilities Plan alternatives, an estimate of the cost to undertake special protective and restorative measures along the interceptor route through Ernie Miller Park, and a presentation of a new alternative as the recommended project.

The recommended project (the 201's Selected Project) includes initial construction of a 2 mgd oxidation ditch treatment plant at the confluence of Cedar and Little Cedar Creeks; a gravity interceptor sewer, sized for the peak wet weather flow generated by the ultimate development of the watershed (using the higher definition of peak flow), along Little Cedar Creek from the K-7 lift station to the new plant; and branch interceptors to allow abandonment of the Younts and Prairie Center pumping stations and the Leeview Estates treatment plant. In 1985, a gravity interceptor will be built along Cedar Creek from near Cedar Lake to a pumping station at the north end of Olathe Lake, and a force main will be built along Cedar Creek to the treatment plant. In 1990, a parallel 1 mgd oxidation ditch will be added to the treatment plant, the Olathe Lake pump station will be enlarged, and the gravity interceptor along Cedar Creek will be extended south to serve the remaining parts of the Upper Cedar Creek basin. The total capital cost of the applicant's recommended plan, at 1979 prices, is estimated in the Supplement to the Facilities Plan to be $14,830,000. The total present worth of the plan, including estimated operation and maintenance costs, is $12,680,000. This is the second-highest present worth of the nine alternatives considered by the applicant.

C. ISSUES

The primary issues leading to the preparation of this EIS, as identified in the Notice of Intent to Prepare an EIS, are described below.

1. Ernie Miller Park

The original issue was the need to evaluate the magnitude and severity of the adverse physical and biological impacts of constructing a gravity interceptor sewer through this 113-acre natural area. In addition to the direct loss of approximately seven acres of woodland along a 2,900-foot-long, 105-foot-wide construction easement through the park, the effects of the cleared strip on the value of the remaining parkland resource, the appropriateness and cost of the proposed mitigative measures, and the cost, effects, and availability of alternate routes and construction procedures must be evaluated.

Since the park was purchased, in part, with Land and Water Conservation Fund Act of 1965 funding, the requirements to obtain approval of the Secretary of the Interior and to replace the seven acres with an equal amount of parkland must also be considered. The essence of this issue is to determine whether it is better, in the overall analysis, to construct the interceptor through the park, as planned, or to find some means of transporting the wastewater around the park.

2. Growth and Land Use Changes

A number of project area residents are opposed to any further development in the study area, particularly outside Olathe's city limits. Although most of the study area is sparsely populated at present, projections indicate a significant population influx during the planning period. This population increase will cause numerous land-use changes; increased traffic volumes; additional demands for schools, police and fire protection, and other community services; additional stormwater runoff volumes, combined with greater pollutant loadings; and more air pollution. Therefore, the degree to which the proposed project will cause, or make possible, this increased population density needs to be estimated. From that estimate, the extent of the adverse and beneficial secondary impacts attributable to the project can be evaluated, and ways to avoid or reduce the adverse impacts developed.

3. Cultural Resources

The State Historical Preservation Officer has determined that there is a high probability that archaeological and paleontological sites may be affected by the project. In particular, there were three archaeological sites reported to be near the proposed treatment plant location before the Notice of Intent was issued. The presence, location, and probable significance of sites that may be affected need to be determined, and ways to reduce any adverse impacts evaluated.

4. Other Alternatives

The controversy over constructing an interceptor through Ernie Miller Park indicates that alternative routings for that sewer need to be developed and evaluated. The costs of measures to mitigate the various adverse impacts of the proposed project also need to be determined. The controversy over development in the study area and the related contentions that the proposed project will cause serious degradation of Cedar Creek require discussion of an alternative that expands the Harold Street plant and continues to pump wastewater from the Cedar and Little Cedar Creek basins to that facility. The facts that the Harold Street plant is currently overloaded, that the population increase projected for the Mill Creek basin is greater than the existing population of the Cedar and Little Cedar Creek basins, and that much of the project's justification lies in making the Harold Street plant adequate throughout the planning period, without expansion, also indicate a need to further investigate that plant's projected loadings and need for expansion.

5. Erosion and Other Impacts

The area's topography and soil types, in conjunction with the proposed interceptor alignments, make soil erosion during construction, and the resultant siltation and sedimentation of the study area's watercourses, a potentially serious issue. Ultimate disposal of the sludge generated by the new treatment plant was not discussed in the Facilities Plan, and requires investigation. The possible susceptibility of project components to flood damage is another concern requiring more information than was available in the Facilities Plan.

During the early stages of the EIS, two other aspects of the project were identified as having the potential to cause severe adverse impacts:

6. Implementability

About two-thirds of the study area lies outside the city limits of Olathe. This has led to questions concerning the City's legal jurisdiction to provide sewerage service to County residents, and what arrangements have been, or could be, made to allow such service. If the City cannot extend service outside its limits, questions arise regarding the advisibility of continuing with the proposed basin-wide project.

7. Olathe Lake

The Facilities Plan locates the Cedar Creek interceptor along the west side of Olathe Lake, presumably to serve the residential area there. The lake's west bank is nearly vertical, rises 40 to 50 feet above the lake's surface in several places, and consists primarily of sedimentary rock. The physical and economic impracticality of constructing a gravity interceptor on this alignment, and the probability of severe adverse effects on the lake's water quality and on the heavy, but tenuously-established vegetation along the bank, indicate a need for a more detailed examination of this part of the project.

CHAPTER II ENVIRONMENTAL SETTING

This chapter describes the "baseline" physical, biological, and socio-economic conditions in the study area, against which the effects of the proposed action and alternative projects may be measured. As previously mentioned, areas directly related to the identified issues are examined in greater detail than those which are not significantly affected by the project.

A. NATURAL ENVIRONMENT

1. Description of the Study Area

The project area is in central Johnson County, Kansas, in the Kansas River valley. It encompasses some 27,000 acres, and includes the entire Little Cedar Creek basin (7,600 acres), the Upper Cedar Creek basin - the part of the Cedar Creek basin above the confluence of Cedar and Little Cedar Creeks (15,800 acres), and the part of the Mill Creek basin that is within the 1976 corporate limits of Olathe (3,600 acres). All of the Mill Creek basin portion of the study area, about 3,900 acres of the Little Cedar Creek basin, and about 1,600 acres of the Upper Cedar Creek basin, are within Olathe's corporate limits. The remaining 17,900 acres (about 2/3 of the study area) are unincorporated, and are under the jurisdiction of the Johnson County Board of Commissioners.

The boundaries of the study area are shown on Figure 2, in Chapter I. They extend approximately to 103rd Street on the north, 179th Street on the south, Moonlight Road to the west, and Renner Road to the east. With the exception of street and highway rights-of-way, various city parks, public buildings and other facilities, Ernie Miller Park, and Olathe and Cedar Lakes, nearly all land in the study area is privately owned. No properties or easements have been obtained for the proposed sewerage facilities.

The Mill Creek basin portion of the study area is relatively densely developed, but the other two watersheds are sparsely populated. Much of the land, particularly in the Upper Cedar Creek basin, is devoted to agriculture or woodlands. The three creeks exhibit floodplains on the order of 200-1,000 feet wide, with banks and valley walls that are often quite steep. Exposed bedrock in streambanks and road cuts is common throughout the study area.

2. Climate

The Olathe area's climate is continental, with typically cold winters, warm-to-hot summers, and characteristically changeable temperature and precipitation, both diurnal and seasonal. The Rocky Mountains block the eastward flow of Pacific moisture, making the Gulf of Mexico the chief source of moisture. Warm, moist Gulf air, cold Canadian air, and dry air from the west pass through the area. Moderate surface winds predominate, but tornadoes, and heavy thunderstorms with high winds and hail, are not uncommon.

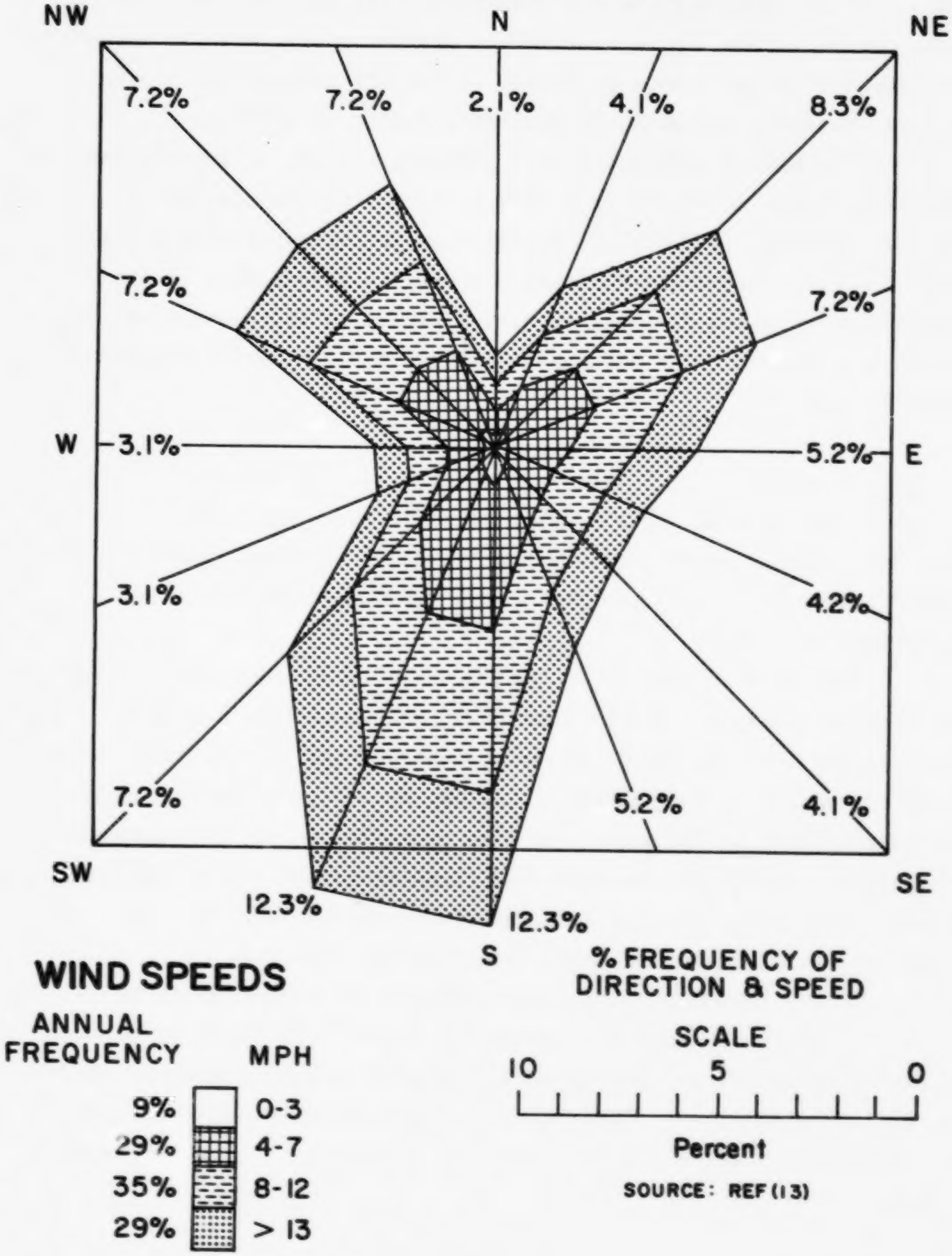
Average annual precipitation for Olathe is 36.2 inches (6). Winters are generally dry, and the most rainfall occurs in June and August.

The area averages 184 frost-free days. The average latest killing frost is about April 17 and the earliest is about October 18. The average depth of annual frost penetration is 15 inches (7).

Winds are generally from the east in March, from the north in January and February, and southerly the other months of the year (see Figure 3).

The average annual temperature is 55.6°F, and the maximum and minimum recorded extreme temperatures are 113° and -22°F. The mean maximum temperature for January is 41°F and the minimum is 21°F. For July, the mean maximum and minimum temperatures are 91°F and 69°F, respectively (6).

ANNUAL SURFACE WIND ROSE
KANSAS CITY, MO.



SOURCE: REF (13)

FIGURE 3

3. Air Quality

The EPA and the Kansas Department of Health and Environment (KDHE) have the same Air Quality Standards. The primary standards define the pollution limits required to protect public health; secondary standards define the limits necessary to prevent adverse effects on any environmental, man-made, or aesthetic factor or process.

The KDHE maintained an air sampling station at the Johnson County Courthouse in Olathe from 1970 to 1974. Olathe air quality data are presented in Table 1. Sulfur dioxide, nitrogen dioxide, and carbon monoxide levels met National Air Quality Standards. Sulfur dioxide and suspended particulate matter trends showed decreasing concentrations; however, the nitrogen dioxide trend indicated increasing concentrations (8).

4. Odor

There are no major odor problems in the project area. Localized problems do occur occasionally around the City landfill, malfunctioning lift stations, the sewage treatment facilities and failed septic tanks (9, 10).

Hydrogen sulfide (H_2S), which has a rotten egg odor, is the most frequently perceived odor around the Harold Street treatment plant and the lift stations, and is a problem whenever the travel time of the raw sewage is long enough to allow the sewage to become septic. Various processes at the plant are also acknowledged to be occasional odor sources. Leaks in the anaerobic digester covers are one source, and odors have been detected from the sludge drying beds when the sludge is discharged before total digestion has occurred.

Odors caused by fires and uncovered putrefying material at the City landfill are also objectional at times. The landfill is on the west side of Olathe, and whenever the wind is from the west, odors are carried to the City. These odors are particularly noticeable in Ernie Miller Park and the Leeview Estates Subdivision, when they occur (9, 11).

TABLE 1
OLATHE AIR QUALITY

Pollutant	National Standards Primary ug/m^3	National Standards Secondary ug/m^3	Levels at Olathe Station ug/m^3
Particulate Matter			
Annual Geometric Mean	75	60	76
24-hour Max[a]	260	150	171
Nitrogen Dioxide			
Annual Arithmetic Mean	100	100	30
Maximum	-	-	82
Carbon Monoxide			
8-hour Max[a]	10,000	10,000	6.7
1-hour Max[a]	40,000	40,000	14
Sulfur Dioxide			
Annual Arithmetic Mean	80	60	18
24-hour Max[a]	365	260	122
3-hour Max[a]	-	1,300	-

[a] Not to be exceeded more than once per year.

Source: Ref. (8)

5. Noise

No known noise studies have been conducted in the study area. Noise levels above the background of the city's normal activities are generally not a problem. At times, however, the noise of traffic on Interstate 35 exceeds the normal background level. Occasionally, equipment operating in the City landfill and traffic on Kansas Highway 7 can be heard in Ernie Miller Park. The only noise at the proposed treatment plant site above the background level of a woodland area is the occasional sound of farm equipment.

6. Topography

The study area is within the Central Lowlands Physiographic Province. Johnson County is partly in the Attenuated Drift Border division of the Dissected Till Plains and partly in the Osage Cuestas division of the Osage Plains (12). Because of the relatively small study area and the difficulty in defining strict boundaries, both physiographic divisions were investigated.

The topography of the Till Plains is depositional and of low relief. The dominantly limestone-and-shale bedrock produces silty clay on gently undulating terrain. Usually, a thin loess mantle covers the area. This windblown silt, the underlying tills, and the erosion of exposed rock strata determine the landforms. Glacial landforms are not readily recognizable in the area because they have been significantly modified by erosion and mass-wasting.

The Osage Plains part of this area is characterized by low escarpments trending slightly east of north. This feature is more noticeable in the northwest part of the Cedar Creek basin, where rock outcrops are more prominent.

Cedar Creek, and its right-hand tributary Little Cedar Creek, drain northward into the Kansas River, as does Mill Creek. These streams have steeper gradients and greater local relief than the east- and south-flowing streams in the area. The difference in elevation in the Cedar Creek watershed is about 370 ft, ranging from a high of 1120 ft just east of Bonita to a low of 750 ft at the confluence with the Kansas River. Little Cedar Creek watershed elevations range from 1050 ft near the intersection of U.S. Highway 56 and Kansas Highway 7 to 835 ft at the confluence with Cedar Creek. Elevations in the study area part of the Mill Creek watershed range from 1087 to 940 ft. All elevations are mean sea level.

7. Geology

The planning area contains sedimentary bedrock deposited in the shallow seas that advanced from the southwest during the late Pennsylvanian period. These rocks are mostly shales, with prominent limestone strata, and a few sandstones. Covering the bedrock is Kansan glacial till and a thin veneer of loess. Erosion of resistant and weak strata determine the landforms in the areas of outcrop, where the rock is near the surface. Regional deformation of the sedimentary rocks is slight, so they appear to be nearly flat.

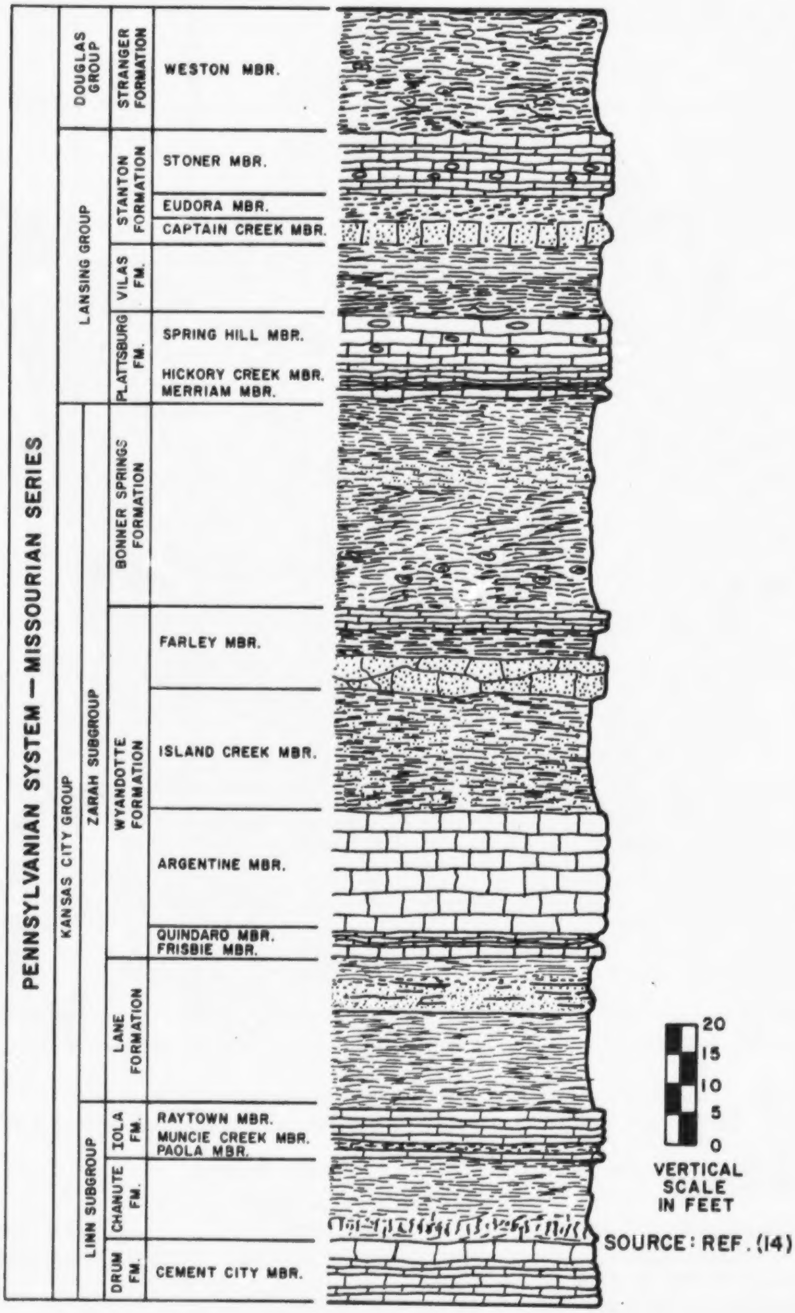
The area is in the Forest City structural basin, between the Ozark Dome in south-central Missouri and the Nemaha uplift, which extends from Omaha to Oklahoma City. The regional dip of the bedrock is to the northwest, at about 12 ft per mile. The structure is locally modified by the northeast-trending Gardner anticline, which causes the Drum Limestone to outcrop at the confluence of Cedar Creek and Little Cedar Creek, and roughly marks the anticlinal axis. This structure produced the Olathe and Olathe North natural gas fields.

The Upper Pennsylvanian System outcrops within the study area belong to the Douglas, Lansing and Kansas City Groups of the Missourian Series. The formations comprising the Missourian Series are listed in descending order in Table 2, and are illustrated in Figure 4. Figure 5 shows where the various formations outcrop in the study area.

TABLE 2

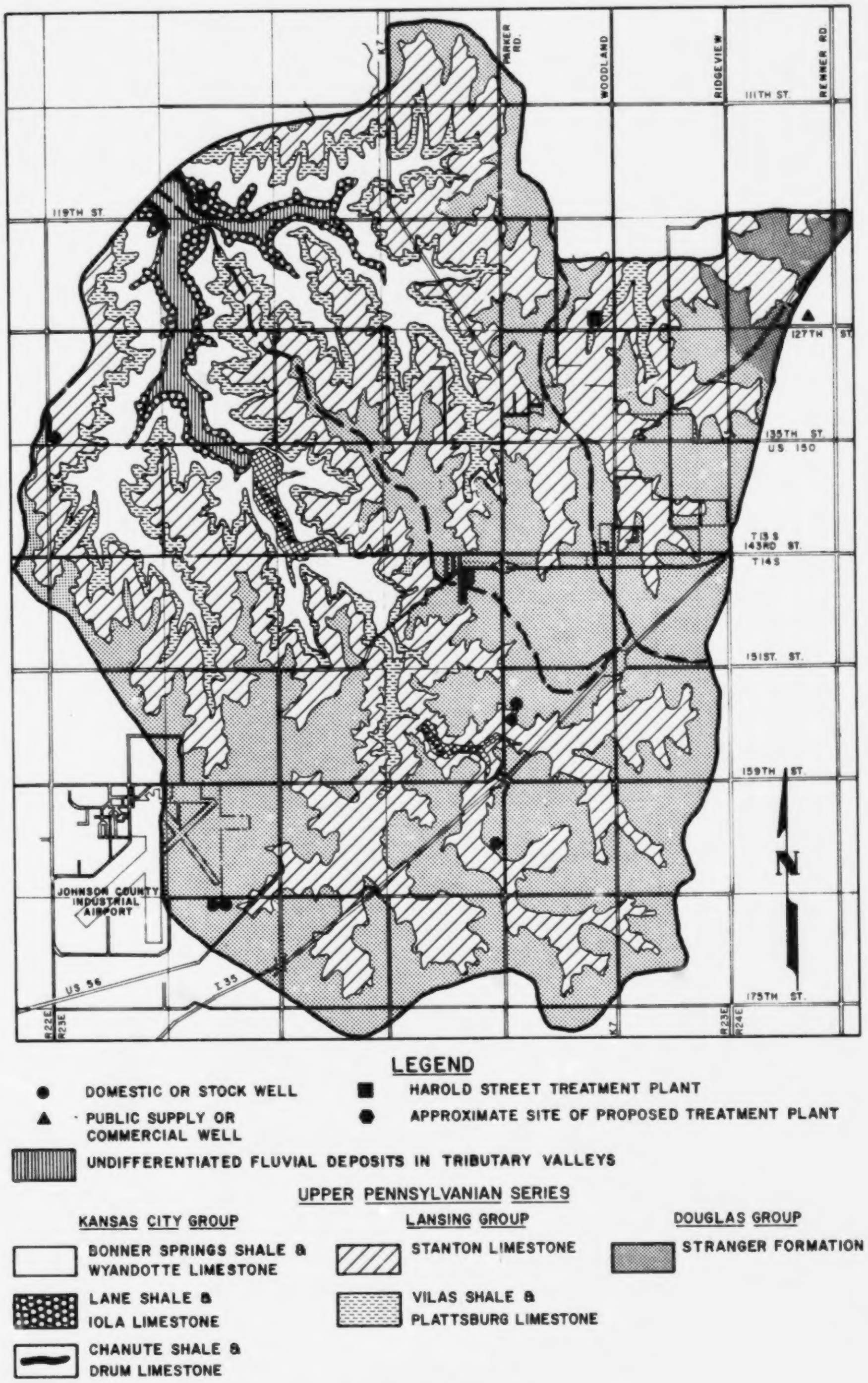
PENNSYLVANIAN FORMATIONS IN STUDY AREA

- Pennsylvanian System
    - Missourian Series
        - Douglas Group
            - Stranger Formation
                - Weston Shale
        - Lansing Group
            - Stanton Limestone
                - Stoner Limestone
                - Eudora Shale
                - Captain Creek Limestone
            - Vilas Shale
            - Plattsburg Limestone
                - Spring Hill Limestone
                - Hickory Creek Shale
                - Merriam Limestone
        - Kansas City Group
            - Zarah Subgroup
                - Bonner Springs Shale
                - Wyandotte Limestone
                    - Farley Limestone
                    - Island Creek Shale
                    - Argentine Limestone
                    - Quindaro Shale
                    - Frisbie Limestone
                - Lane Shale
            - Linn Subgroup
                - Iola Limestone
                - Raytown Limestone
                - Muncie Creek Shale
                - Paola Limestone
                - Drum Limestone


PENNSYLVANIAN SYSTEM — MISSOURIAN SERIES
DOUGLAS GROUP
STRANGER FORMATION
WESTON MBR.
LANSING GROUP
STANTON FORMATION
STONER MBR.
EUDORA MBR.
CAPTAIN CREEK MBR.
VILAS FM.
PLATTSBURG FM.
SPRING HILL MBR.
HICKORY CREEK MBR.
MERRIAM MBR.
KANSAS CITY GROUP
BONNER SPRINGS FORMATION
ZARAH SUBGROUP
WYANDOTTE FORMATION
FARLEY MBR.
ISLAND CREEK MBR.
ARGENTINE MBR.
QUINDARO MBR.
FRISBIE MBR.
LANE FORMATION
LINN SUBGROUP
IOLA FM.
RAYTOWN MBR.
MUNCIE CREEK MBR.
PAOLA MBR.
CHANUTE FM.
DRUM FM.
CEMENT CITY MBR.
20
15
10
5
0
VERTICAL SCALE IN FEET

SOURCE: REF. (14)

FIGURE 4
GENERALIZED GEOLOGIC COLUMN


K7
PARKER RD.
WOODLAND
RIDGEVIEW
RENNER RD
111TH ST.
119TH ST.
127TH ST
135TH ST
US 150
T13S
143RD ST.
T14S
151ST. ST.
159TH ST.
175TH ST.
N
JOHNSON COUNTY INDUSTRIAL AIRPORT
US 56
I 35
K7
R22E
R23E
R23E
R24E
LEGEND
● DOMESTIC OR STOCK WELL
▲ PUBLIC SUPPLY OR COMMERCIAL WELL
■ HAROLD STREET TREATMENT PLANT
⬢ APPROXIMATE SITE OF PROPOSED TREATMENT PLANT
▥ UNDIFFERENTIATED FLUVIAL DEPOSITS IN TRIBUTARY VALLEYS
UPPER PENNSYLVANIAN SERIES
KANSAS CITY GROUP
☐ BONNER SPRINGS SHALE & WYANDOTTE LIMESTONE
▩ LANE SHALE & IOLA LIMESTONE
▬ CHANUTE SHALE & DRUM LIMESTONE
LANSING GROUP
▨ STANTON LIMESTONE
▤ VILAS SHALE & PLATTSBURG LIMESTONE
DOUGLAS GROUP
▦ STRANGER FORMATION

SOURCE: REF. 12

FIGURE 5
GEOLOGIC MAP

Earthquakes are infrequent in Kansas (116), and the study area is in a low-risk zone for earthquake damage. Although earthquakes have been recorded in the Olathe area, their origins have been to the west, northwest, and southeast. Those to the west and northwest have been centered near Lawrence, Topeka, and Manhattan, and have been associated with the Nemaha structure. Earthquakes to the southeast have been centered in the Missouri Ozark region.

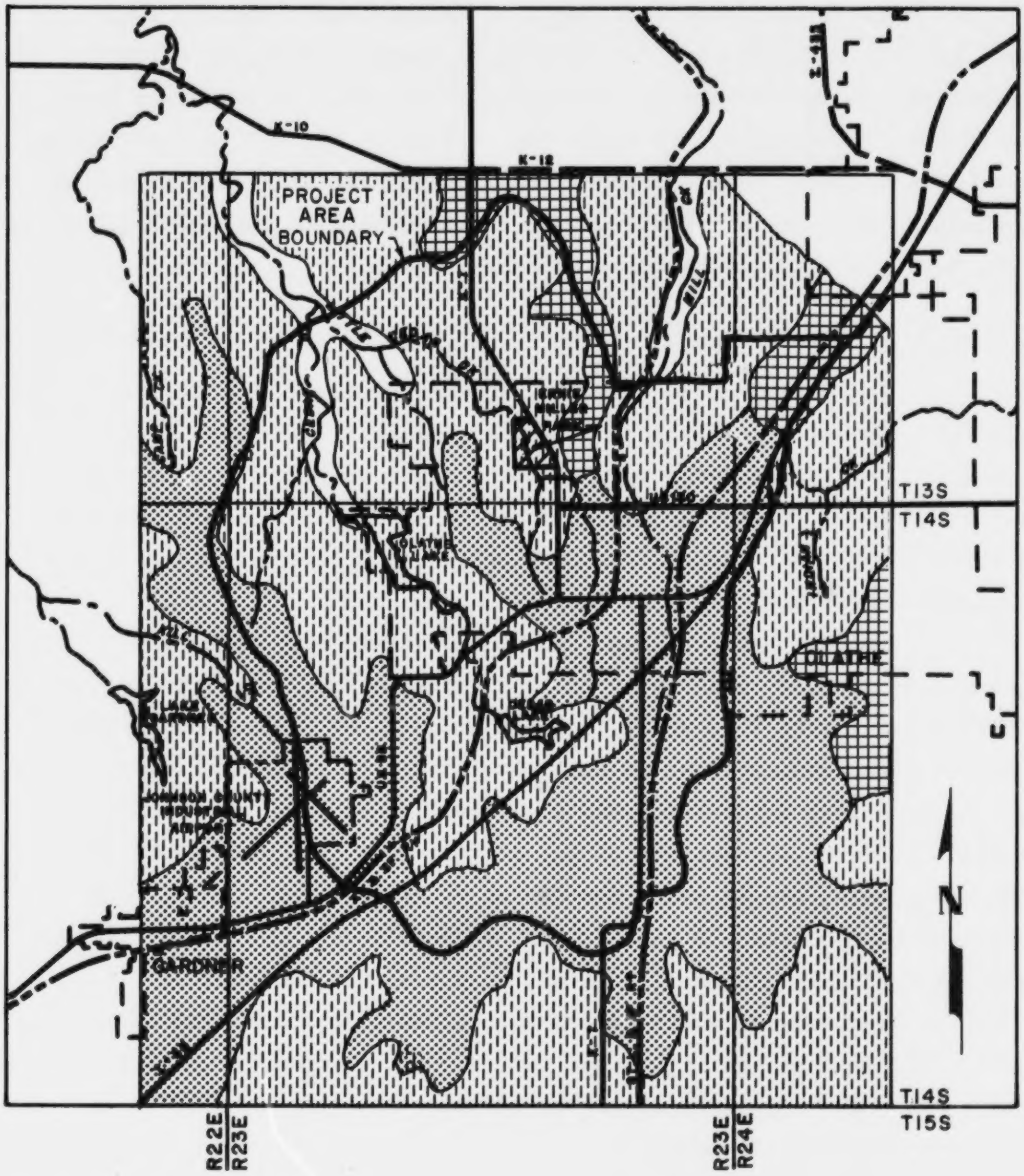
8. Soils

The soils in the Cedar Creek watershed were formed from windblown loess, glacial outwash, and alluvials, colluvials, and residuals derived from the weathering of shale and limestone bedrock. The soil cover, including unconsolidated deposits, is variable within the study area, and ranges from rock outcrops on the hilltops to possibly 50 ft thick in the valleys.

a. General Descriptions. The soils in the study area are grouped by the U.S. Department of Agriculture's Soil Conservation Service (SCS) into four general associations. The general distribution of these associations in the project area is shown on Figure 6.

A soil association has a distinctive proportional pattern of soils. It normally consists of one or more major soils, and at least one minor soil, and is named for the major soils. The soils in one association may occur in another, but in a different pattern. Soil associations give a general idea of the soils in a large area, i.e., a county. Some mapping units are made up of soils of different series, or of different phases within one series. A soil complex consists of two or more soils so intricately mixed that they cannot be shown separately on a soils map.

All soils in the study area are considered "prime farmland" by SCS except the Sogn-Vinland Complex. SCS also rates soils for their suitability for use in constructing various types of facilities, including septic tank leach fields and lagoon embankments. The ratings


K-10
K-12
PROJECT AREA BOUNDARY
OLATHE
GARDNER
T13S
T14S
T14S
T15S
R22E
R23E
R23E
R24E
N

SOURCES: REF. (15, 16 & 17)

SOIL ASSOCIATIONS

▥ = POLO-OSKA-SOGN

▒ = WOODSON-MARTIN

☐ = KENNEBEC-CHASE-READING

▦ = POLO-GRUNDY-OSKA

FIGURE 6
GENERAL SOIL MAP

are based on the degree of the soil's limitations for the stated use. A "slight" rating indicates few or no problems associated with using that soil for the stated purpose. A "moderate" rating indicates problems requiring special care when using the particular soil, such as frost heave, high shrink-swell potential, differential settlement, steep slopes, high water table, high rock content, or flooding. A "severe" rating suggests that the soil's problems are so intense as to make its use for that purpose highly questionable. The ten soil types found in the study area are briefly described below, along with their SCS ratings for use in septic system leach fields and sewage lagoon embankments.

1) Chase Silt was formed from alluvium on flood plains and low terraces. It is well- to somewhat poorly drained, and has a clayey subsoil. The permeability is slow, resulting in SCS ratings of "severe" for septic fields, but "slight" for lagoons. Bedrock is more than 5 ft below the surface.

2) Grundy Silty Clay was formed on uplands, and is somewhat poorly drained to well-drained. The slopes are gently to moderately sloping. The permeability is slow, and the subsoil is clayey, which forms a perched water table in the wet seasons. The depth to bedrock exceeds 5 ft. The SCS rating for septic fields is "severe" because of the slow permeability and wetness. It is rated "moderate" for lagoons because of the slopes usually encountered.

3) Kennebec Silt was formed in the bottomlands from creek-bed alluvium and Kansan glacial till. It is subject to frequent flooding and siltation, causing a "severe" rating for both septic fields and lagoons. The soil is moderately well-drained, and has moderate permeability and a clay substratum. The depth to rock is usually greater than 10 ft.

4) Ladoga Silt was formed on uplands, and is somewhat poorly drained. The slopes are moderate, causing a "moderate" rating for lagoons. Permeability is slow because of a clayey subsoil, causing

a "severe" rating for septic fields. The depth to bedrock is greater than 5 ft.

5) Martin Silty Clay was formed from silty and clayey shale between limestone scarps on the uplands. The soil is moderately well-drained, with slow permeability that gives it a "severe" rating for septic fields. It is highly erodible on steep hillsides, and deep gullies are common, causing a "moderate" rating for lagoons. The depth to bedrock is more than 4 ft.

6) Oska Silty Clay was formed on intermediate slopes from loess or interbedded limestones and slabs. The soil is silty, moderately well-drained, and has slow permeability. The subsoil is clayey. The soil is easily eroded, and the depth to bedrock is from 2 to 4 ft. The SCS rating for septic fields is "severe" because of both the slow permeability and the depth to rock; the latter factor also cause a "severe" rating for lagoons.

7) Polo Silt was formed on valley slopes and uplands from loess or from interbedded clay, shale, and limestone. The soil is moderately well-drained, but permeability is very slow below a depth of 20 inches, causing a "severe" septic field rating. The depth to bedrock is more than 5 ft. The lagoon rating is "moderate" because of slope.

8) Reading Silt was formed from medium to moderately-fine-textured alluvials on nearly level land in either high bottoms or low terraces. The soil is well-drained, and has moderately slow permeability, which causes a "moderate" rating for septic fields. The depth to bedrock is more than 5 ft. The lagoon rating is "moderate" because of seepage.

9) The Sogn-Vinland Complex is a shallow, excessively-drained soil formed from interbedded limestone and shale. It is a silty clay, and limestone outcrops are common. The depth to bedrock varies from 4 to 20 inches. The ratings for both lagoons and septic fields are "severe" because of the shallow rock, and slope also adds problems for lagoon uses.

10) Woodson Silt was formed from loess or old alluvial materials on nearly level uplands. Permeability of the soil is very slow. The soil is poorly drained, and perched water tables are common during the wet seasons. The depth to rock is more than 5 ft. The lagoon rating is "slight," but the septic field rating is "severe" because of both the permeability and the wetness.

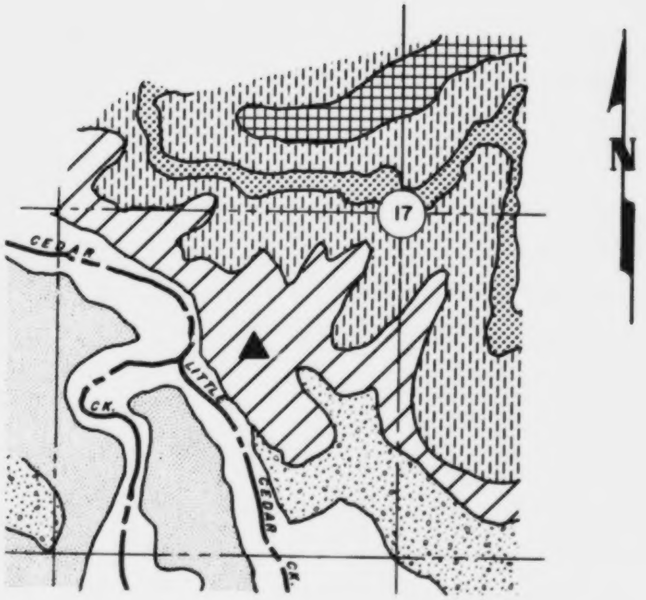
b. Soils at Specific Sites.

1) Proposed Treatment Plant Site. The soils at the proposed treatment plant site are shown on Figure 7. The creek bed and bottomland are Kennebec soil. To the east, where the plant will probably be located, is Vinland Rock outcrop. Upslope, the soil is the Oska-Martin complex. Above this is a narrow band of Sogn-Vinland, and Polo soil on the upland marks the drainage divide. South of the confluence, between the creeks, is Reading soil.

The SCS rates all of the soils at this location as "severe" for building-site development. The Kennebec soils are subject to frequent flooding and frost heave, and have low strength; the Reading soils are subject to flooding; the Oska-Martin and Polo soils are subject to shrink-swell, are clayey, and have low strength; and the Sogn-Vinland soils are thin, with rock being close to the surface, and are also found on slopes that make construction difficult.

2) Ernie Miller Park. The soils in Ernie Miller Park (NE 1/4 of Sec. 27) are shown on Figure 8. The creek bed and bottomland are Kennebec soil. Along both sides of Little Cedar Creek, and extending up its tributaries, are bands of Sogn-Vinland soil. The exposure band is wider east of the creek than on the west side. On the uplands are Oska-Martin soils, and Polo soils are found near the ridge tops.

The Facilities Plan proposes that a sewer line be constructed through the park. Soils within the park are rated by SCS as being suitable for only shallow excavation, because of the shallow rock, and their limitations for other construction uses are rated as "severe," for the reasons given in 1), above.


CEDAR
17
N
LITTLE
CK.
CEDAR
CR.

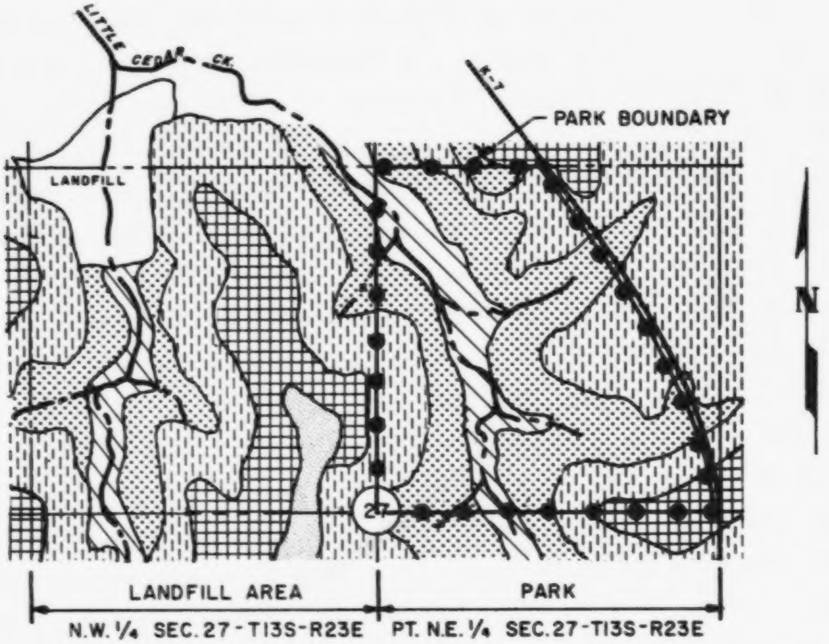
▲ = PROPOSED TREATMENT PLANT
PT. SW 1/4 SEC. 17-T13S-R23E

SOURCE: REF. (15-21)

SOIL TYPE

□ = KENNEBEC
▨ = VINLAND(ROCK OUTCROP)
░ = READING
▩ = OSKA-MARTIN
▒ = SOGN-VINLAND
▦ = POLO
⠿ = LADOGA

FIGURE 7
PLANT SITE SOILS


LITTLE CEDAR CK.
K-7
PARK BOUNDARY
LANDFILL
27
N
LANDFILL AREA
PARK
N.W. 1/4 SEC. 27-T13S-R23E
PT. N.E. 1/4 SEC. 27-T13S-R23E

SOURCES: REF. (15-17)

FIGURE 8
SOIL TYPES IN ERNIE MILLER PARK AND CITY LANDFILL

SOIL TYPE

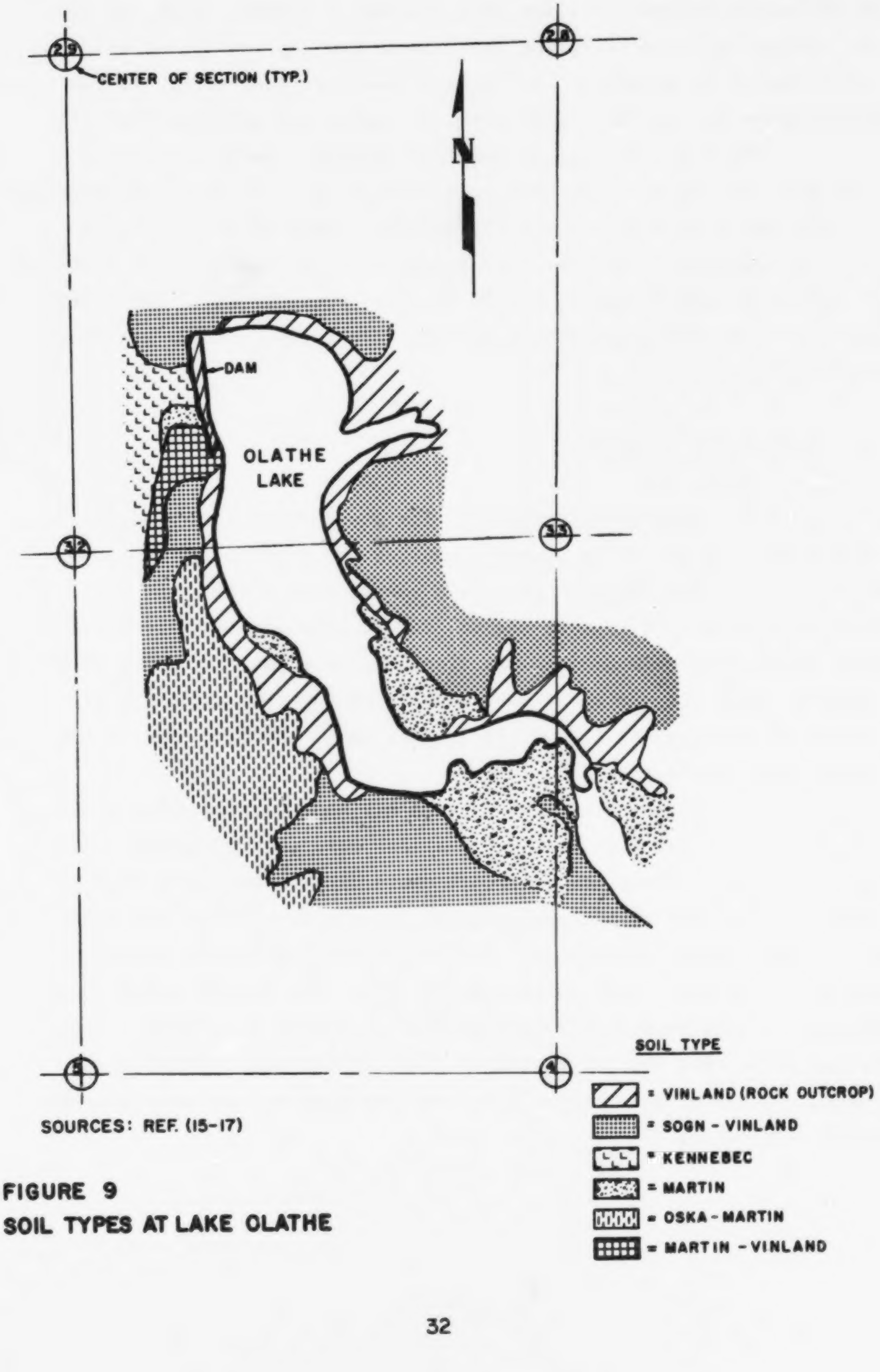
▧ = KENNEBEC
▒ = SOGN-VINLAND
▥ = OSKA-MARTIN
▦ = POLO
░ = GRUNDY

3) Olathe City Landfill Area. The city landfill is in the NW 1/4 of Sec. 27, adjacent to, and west of, Ernie Miller Park. Its soils are also shown on Figure 8. The area drains into a tributary of Little Cedar Creek. The Grundy soils are rated by SCS for landfill sites as "moderate" because of wetness, and are only fair for landfill cover since they are too clayey. The Kennebec soils are rated as "severe" for site use because of wetness and flooding, but are good for landfill daily cover. The Oska-Martin soils are rated as "slight" for a landfill site, but are poor for daily landfill cover, because of being too clayey and having only a thin soil layer. The Polo soils are also rated as "slight" for landfill sites, but are too clayey for daily cover. The Sogn-Vinland soils are rated as "moderate" for landfill sites because of slope, and are rated as poor for daily cover because the soil layer is too thin.

4) Olathe Lake - West Side. The west side of Olathe Lake is in the E 1/2 of Sec. 32. Its soils are shown on Figure 9. The lake was formed by damming Cedar Creek. All soils adjacent to Olathe Lake are rated by SCS as "severe" for septic tank use because of depth to rock, wetness, or slow percolation. The Vinland, Kennebec, Martin and Oska-Martin soils are rated as "severe" for shallow excavation, for the same reasons given for building site development in 1), above. Septic tank problems have occurred along Lake Shore Drive because of the shallow depth to rock (10). The Facilities Plan proposes a sewer line on the west shore of Olathe Lake. The bluffs there are nearly vertical, and are almost solid rock. There is almost no horizontal space between the bluff and the lake shore, and the locations of the roadway, bluff, and residences leave little room in which to build a level working area.

9. Groundwater Resources

No extensive fresh water aquifers exist in the consolidated sedimentary rocks of the study area. Alluvial aquifers are restricted


29
28
CENTER OF SECTION (TYP.)
N
DAM
OLATHE LAKE
32
33
5
4
SOIL TYPE
▨ = VINLAND (ROCK OUTCROP)
▦ = SOGN - VINLAND
= KENNEBEC
= MARTIN
= OSKA - MARTIN
= MARTIN - VINLAND

SOURCES: REF. (15-17)

FIGURE 9
SOIL TYPES AT LAKE OLATHE

to the stream valleys, and are very limited in extent. Recharge of the underground reservoir, the only source for shallow upland wells, is by local precipitation. Recharge is seasonal and, except in the Kansas River valley, well discharges are small and undependable (12).

The State Geological Survey of Kansas reports four wells from bedrock sources. Two shallow wells (12 to 20 ft deep) are reported in Sections 11-T14S-R23E and 30-T13S-R23E. These wells are in the Stanton Limestone formation. Two deeper wells are reported in Sections 11 and 15-T14S-R23E, 115 ft and 84 ft deep, respectively. The wells are in the Wyandotte and Bonner Springs formations. Yields are on the order of 1-5 gpm.

10. Terrestrial Ecology

a. Vegetation

1) Regional Vegetation. The study area is in a region of overlap or transition (an ecotone) between the eastern oak-hickory forest and the big bluestem prairie biomes. Such a community is characteristically a diverse region, for it supports many species from both overlapping communities, and also species which only occur in the ecotone. Both the number of species and the population density of individual species are frequently greater in the ecotone than in the communities flanking it (22).

The character of this ecotone has been greatly altered. The original big bluestem prairie associations have mostly vanished due to agricultural practices and livestock overgrazing. Less desirable range species such as bluegrass, brome, fleebane, ironweed and other weeds have become established. Trees and shrubs have also appeared, replacing the grasslands in many areas (23). The eastern oak-hickory forest has also been either systematically removed or altered. Contributors to this decline have been clearing for agricultural uses, commercial timber harvesting, livestock overgrazing, and most recently, urban development.

2) Site Vegetation. The communities in the project area are representative of the transitional nature of the region, exhibiting a mosaic-like mixture of trees and grasses (23). Tables B-1 and B-2, in Appendix B, list the trees, shrubs and vines common to the area by genera and number of species. The study area contains four plant associations: 1) cropland; 2) pasture; 3) forest - riparian, cove or ravine, and slope and upland forests; and 4) urban. These associations and their distributions were taken from mapped land use data that was based on high-altitude color infrared aerial photography by the National Aeronautics and Space Administration (24). The percentages given below are the breakdowns for the entire basins. Although the Mill Creek basin is almost completely urban within the study area, the basin-wide values for the Cedar Creek basin (including Little Cedar Creek) are believed to be representative of the study area.

a) Cropland. Thirty-four percent of the Cedar Creek and 29 percent of the Mill Creek watersheds are utilized for crop production. Active agricultural lands include milo, wheat, and corn fields on the gently rolling hills in the southern quarter of the Cedar Creek watershed and in the north and northwestern sections of the Mill Creek basin (24).

b) Pasture. Pastures and other open lands containing primarily herbaceous vegetation occupy 37 percent of both the Cedar and Mill Creek watersheds. These areas are found in both valley bottoms and ridge tops in the project area and are typically used as rangelands. The vegetation is characteristically maintained in an early seral stage of ecological succession. Dominant plants in these areas are usually tall grass and forb species. Pastures are highly variable depending on the frequency and duration of usage. If they have been abandoned or mismanaged, a number of woody species have become established. These areas are classified as being in an "old field" stage of plant succession.

c) Forest. Forests are the least-represented vegetation type in the Cedar and Mill Creek basins, occurring on 20 percent and 17 percent of each basin, respectively. Forests are generally limited to the steep slopes, ridges, coves and floodplains that are not conducive to agricultural or range usage. Recognizable forest associations present in the project area have apparently developed, like the regional forest associations, in response to topographic and associated soil moisture conditions. Forest associations identified include riparian or bottomland, cove or ravine, and slope and ridge top forests (23).

i) Riparian Forests. Riparian forests are poorly represented because of the land use pressure for cropland, pasture and urban development, and the lack of major stream valleys and associated broad floodplains. Typical riparian forests were observed in the more rural northern parts of the Cedar and Little Cedar Creek basins.

ii) Cove or Ravine Forests. Forests in cove and ravine areas are generally composed of species preferring mesic (balanced moisture) soil conditions. These forests are also found on certain low slope and northern slope exposures. The vegetation found around the periphery of Cedar and Olathe Lakes is predominately a bottomland association (25).

iii) Slope and Ridge Top Forest. Most slope and ridge tops have relatively xeric (dry) conditions compared to the riparian and cove or ravine sites. However, these forests are highly variable, consisting of a mixture of tree species that can tolerate a wide range of moisture conditions.

d) Urban. The urban area is not a distinct ecosystem, but indicates land which has been altered by human activity. Urban areas are broadly defined to include both the central city and suburban areas. Eight percent the Cedar Creek basin, and 16 percent of the Mill Creek basin, are classified as urban (24).

b. Wildlife. Wildlife in the project area have historically been, and are, those species characteristic of the deciduous forest - tall-grass prairie ecotone. Certain species, particularly large carnivores and herbivores such as the bison, bobcat, plains wolf, and puma, are now extinct or extremely rare in this region. As a result of previous land clearing, the available habitat is predominately that of edge species, i.e., wildlife inhabiting the overlapping zone between forest and grassland. There are no wetlands or marshes. The only aquatic habitats for riparian wildlife occur along the occasional man-made ponds, the two lakes, and Cedar and Mill Creeks.

1) Mammals. There are 52 mammals whose range includes the project area (see Table B-3 in Appendix B) (26). The population status column of Table B-3 indicates the frequency with which the species are found in the Kansas City region. Suitable habitat for many of the species is found within the project area, although it is extremely limited for such species as the cave-dwelling bats, bobcat, spotted skunk, and long-tailed weasel, which require relatively specialized habitats. The most abundant mammals are those species that occur over a wide range of habitats. This includes small rodents such as the deer mouse, and such smaller game species as the eastern cottontail rabbit (26, 27). Species that are near the edge of their distribution are expected to be uncommon.

No mammals were observed during a December site visit except for a road-killed striped skunk. However, signs, including fecal pellets and tracks, of the beaver, cottontail rabbit, gray squirrel, raccoon, and white-tailed deer were noted. Those species whose range includes the project area, and that are considered to be threatened or endangered, are discussed in Section 14 of this part.

2) Birds. Table B-4, in Appendix B, lists the bird orders that have been sighted in the region, and the number of species per order (26). Most of the songbird species have an extensive range in the midwestern United States and are common residents, while other species, particularly the waterfowl, shorebirds and certain songbirds, including a number of sparrows and warblers, are found only during their spring or fall migrations. Species that are breeding residents, but migrate from the area in the winter months, include swifts, swallows,

thrashers, thrushes, vireos, and warblers. Very few species are found in the project region only as winter residents. Year-long residents in the region include hawks, owls, woodpeckers, and crows (26).

Seven nongame species were identified during a site reconnaissance: crow, cardinal, goldfinch, junco, blue jay, and red-tailed and rough-legged hawks. Except for the rough-legged hawk and junco, which are migrants, all are common and permanent residents in the area. Only one game species, the bobwhite quail, was observed. There are no state or federal rare, threatened and endangered birds known to occur in the study area (28, 29, 30).

3) Amphibians and Reptiles. A list of 66 amphibian and reptile species (Table B-5 in Appendix B) most likely to occur in the project area was prepared by considering range descriptions and distributional maps (26, 31). The most abundant habitat available is for those terrestrial species, such as snakes and lizards, that frequent pastures and woodlands. Only limited habitat is available for the aquatic frog, salamander, and turtle species characteristic of large streams, ponds and marshes. Certain amphibians, such as the tree frogs and toads, inhabit water only during the spring, utilizing temporary ponds or swamps for breeding purposes. Three venomous snakes occur in the region, the northern copperhead, timber rattlesnake, and the western massasauga, and all are considered to be either uncommon or rare. No herptile species is of any significant local commercial value (26). Rare, threatened and endangered species are discussed in Section 14 of this part.

11. Surface Water Resources

Surface waters in the study area consist of Cedar Creek, Little Cedar Creek, Mill Creek, Olathe Lake, Cedar Lake, numerous farm ponds, and sewage lagoons. The two lakes, which also serve as reservoirs for part of Olathe's water supply, were formed by damming Cedar Creek.

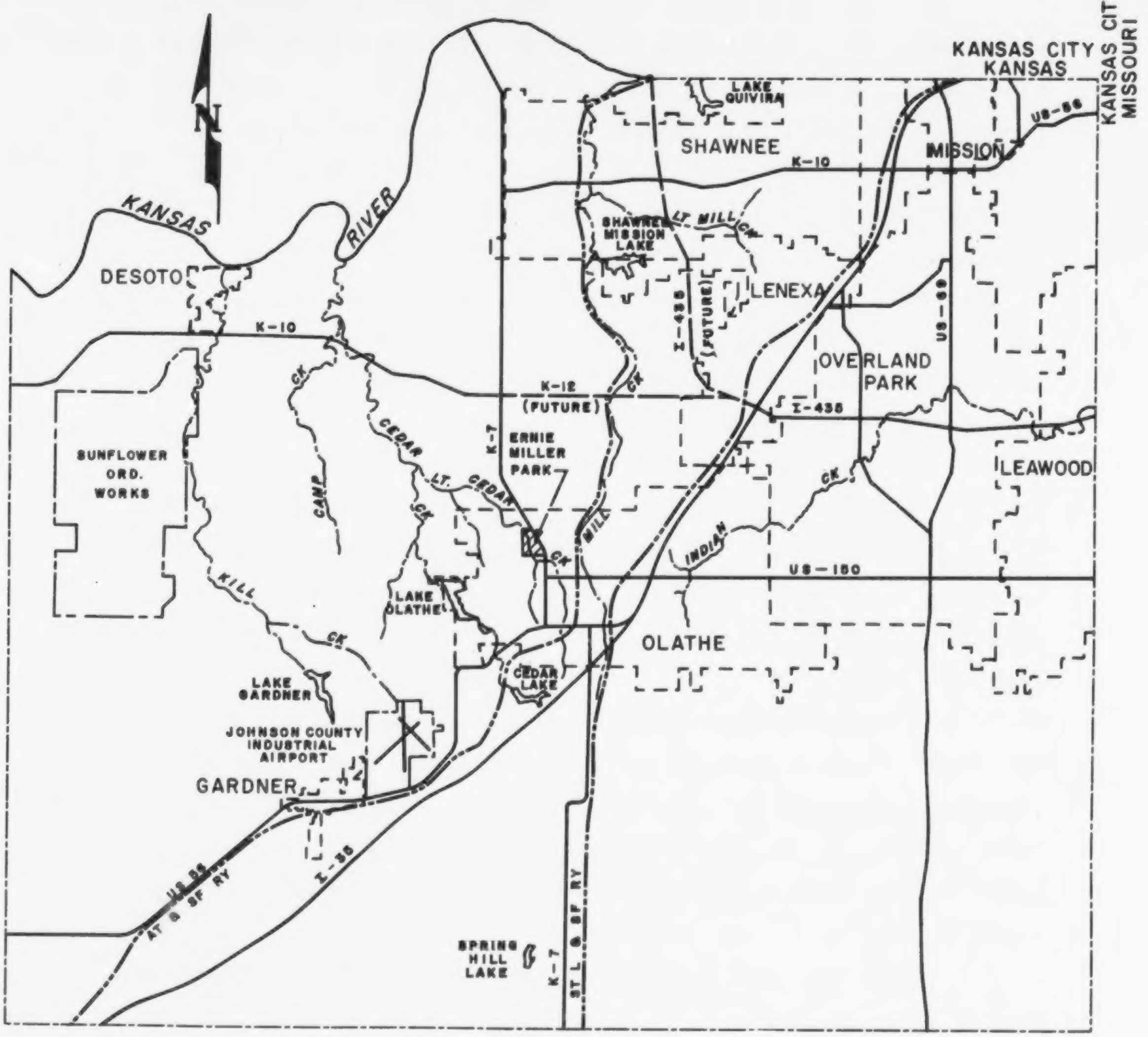
Cedar and Mill Creeks flow northward, and are right bank tributaries of the Kansas River. Cedar Creek drains an area of about

60 square miles, and is about 17 miles long. About 25 square miles of the Upper Cedar Creek Basin (above its confluence with Little Cedar Creek, and exclusive of the Little Cedar Creek basin) are in the study area. The Mill Creek basin covers 40,000 acres (62 square miles), of which the 2,700 acres within the corporate limits of Olathe are in the study area. Mill Creek is about 15 miles long. Both creeks are perennial, second-order streams (24); however, their headwaters and tributaries (Little Cedar, Camp, Coon, and Little Mill Creeks) may be intermittent during summer and autumn droughts. Cedar Creek flows continuously below its confluence with Little Cedar Creek. Mill Creek is intermittent until it receives continuous flow from the Harold Street wastewater treatment plant (4, 32, 33, 34). Little Cedar Creek is a right bank tributary of Cedar Creek, drains about 12 square miles, and is entirely within the study area.

Olathe Lake and Cedar Lake cover 190 acres and 77 acres, respectively (12), and are the only lakes in the study area. Both are in the Upper Cedar Creek basin. The lakes were built primarily for water supply, but also provide a significant amount of recreation, including boating, swimming and fishing. Olathe Lake is also used for duck hunting.

Other nearby surface water resources outside the study area, but within Johnson County, are: Gardner Lake, west of Johnson County Industrial Airport; Spring Hill City Lake, 10 miles south of Olathe; Lake Quivira, on the northern edge of the county; Shawnee Mission Park Lake; and the Kansas River. The region's surface water resources are shown on Figure 10.

The overflow limit at the confluence of Cedar Creek and Little Cedar Creek for a Standard Project Flood (SPF) is elevation 845, msl. For an Intermediate Regional Flood (IRF), the elevation is 840 feet. The SPF defines the maximum flood potential from the most severe combination of meteorological and hydrological conditions considered reasonably characteristic of the region. The IRF, also known as the "100-year flood," may be expected to occur more frequently, but is not as severe as the SPF.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KANSAS RIVER
DESOTO
K-10
SUNFLOWER ORD. WORKS
CK
CAMP
CEDAR
LT. CEDAR
CK
KILL
CK
LAKE GARDNER
JOHNSON COUNTY INDUSTRIAL AIRPORT
GARDNER
US 56
AT & SF RY
I-35
LAKE OLATHE
CEDAR LAKE
K-7
ERNIE MILLER PARK
K-12 (FUTURE)
MILL
CK
LAKE QUIVIRA
SHAWNEE
K-10
SHAWNEE MISSION LAKE
LT. MILL CK
I-435 (FUTURE)
LENEXA
MISSION
US-56
KANSAS CITY KANSAS
KANSAS CITY MISSOURI
US-69
OVERLAND PARK
I-435
LEAWOOD
INDIAN
CK
US-150
OLATHE
SPRING HILL LAKE
K-7
ST L & SF RY

FIGURE 10
SURFACE WATER RESOURCES

The average difference in elevation between SPF and IRF is about 3 feet upstream of Olathe Lake, and varies from 4 ft to 8 ft downstream from the lake. The elevation from flow line to IRF is about 12 ft at Mile 7.75 (the confluence with Little Cedar Creek). The SPF elevation varies from 984 at the Cedar Lake outlet (Mile 15.1) to 945 at the confluence with Little Cedar Creek.

Olathe Lake and Cedar Lake were constructed for the purpose of water supply, with recreation being a fringe or secondary benefit. Their use for flood control was not considered. The two dams favorably alter the flood profile somewhat; however, the flood control potential of the lakes is minimal. The Olathe Lake dam elevation is about two feet below the IRF, and four feet below the SPF. At the weir, up-stream of 143rd Avenue, the IRF is about three feet above the weir, and the SPF is about six feet above the weir.

The IRF will discharge about 8,000 cfs from Little Cedar Creek and 3,900 cfs from Cedar Creek; the SPF is calculated to discharge 15,900 cfs and 18,200 cfs, respectively. Average velocities that may be expected during the IRF are 12.4 fps in the channel, and 5.5 fps on the overbank. Corresponding values for the SPF are 13.8 and 5.6 fps. These velocities were calculated for a point about 1/2 mile downstream from the Cedar Creek-Little Cedar Creek confluence.(35).

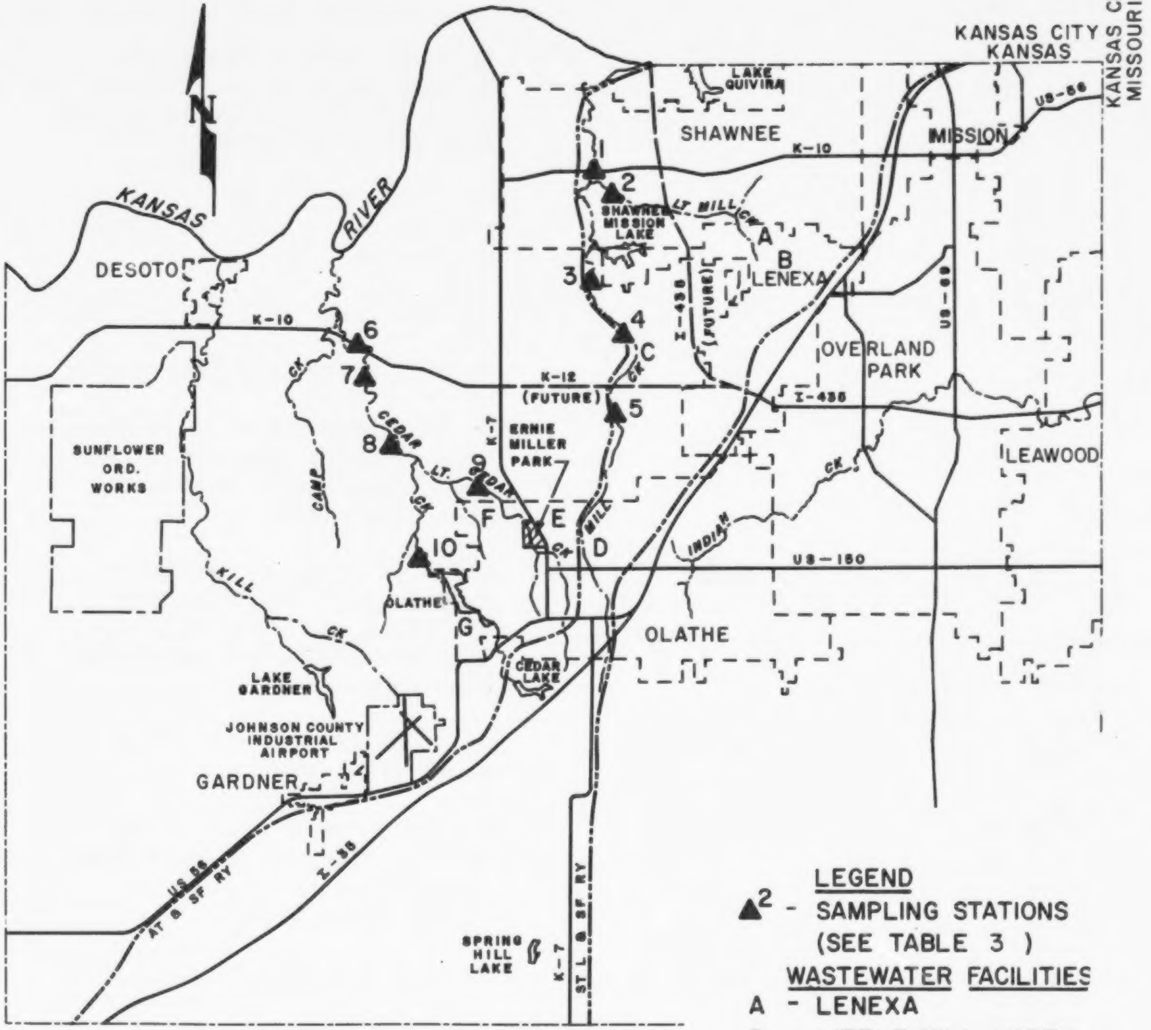
12. Water Quality

The Kansas State Department of Health and Environment has set water quality standards for the various streams and impoundments in the state to protect and enhance their value for their designated uses. Water with existing quality better than the established criteria will be maintained at that quality unless it is proven that a change is justified by necessary economic or social development. All domestic wastes must receive at least secondary treatment. All industrial wastes must receive an equivalent degree of treatment, or control consistent with the waste characteristics and the quality of receiving waters.

a. Stream Classifications. All waters in Kansas are grouped into either Class A or Class B, depending upon their uses. Class A waters are protected for body contact recreation (where the human body may come in direct contact with the raw water to the point of complete submergence); preservation and propagation of desirable species of fresh warm-water aquatic biota, semi-aquatic life, waterfowl, and wildlife; public and industrial water supplies; and agricultural uses. Class B waters are protected for the same uses as Class A waters, except that they only need to be suitable for secondary contact recreation (intended for uses such as fishing, where ingestion of the water is not probable) (36). Mill, Cedar, and Little Cedar Creeks are designated as Class B waters. Since Olathe and Cedar Lakes are used for swimming, they are Class A waters.

b. Stream Standards. The water quality standards applicable to Class B waters include, as principal criteria, a fecal coliform count no greater than 2,000 colonies per 100 milliliters (ml), and a dissolved oxygen concentration no lower than 5 milligrams per liter (mg/l). The standards for Class A waters are the same as for Class B, except that the average fecal coliform content may not exceed a geometric mean of 200 colonies per 100 ml (37).

c. Existing Water Quality Data. Information on the water quality of both Cedar and Mill Creeks (24, 39) was obtained from the sampling stations illustrated in Figure 11 and described in Table 3. Data obtained from these stations are presented in Tables C-2 through C-7, in Appendix C. Data was also obtained from the City for Mill Creek immediately above and below the Harold Street Plant outfall. This data is given in Table C-8, in Appendix C. No data were available to characterize Cedar Lake or Olathe Lake. The data indicate that most water quality standards are met, with the exception of the dissolved oxygen (DO) standard of 5 mg/l. None of the available data include coliform counts.


N
KANSAS RIVER
DESOTO
K-10
SUNFLOWER ORD. WORKS
CAMP CK
CEDAR CK
LT. CEDAR CK
KILL CK
LAKE GARDNER
JOHNSON COUNTY INDUSTRIAL AIRPORT
GARDNER
US 56
AT & SF RY
I-35
SPRING HILL LAKE
K-7
ST L & SF RY
OLATHE
CEDAR LAKE
ERNIE MILLER PARK
K-12 (FUTURE)
MILL CK
LT. MILL CK
SHAWNEE MISSION LAKE
LAKE QUIVIRA
SHAWNEE
K-10
MISSION
US-56
KANSAS CITY KANSAS
KANSAS CITY MISSOURI
LENEXA
I-435 (FUTURE)
OVERLAND PARK
US-69
I-435
LEAWOOD
INDIAN CK
US-150
OLATHE
1
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10
A
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D
E
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G

FIGURE 11
WASTEWATER FACILITIES & SAMPLING LOCATIONS

LEGEND

▲2 - SAMPLING STATIONS (SEE TABLE 3)

WASTEWATER FACILITIES
- A - LENEXA
- B - LITTLE MILL NORTH
- C - MILL CREEK
- D - HAROLD STREET
- E - LEEVIEW ESTATES
- F - PERSIMMON HILLS
- G - LAKESTONE ESTATES

TABLE 3
SAMPLING STATION LOCATIONS

Station Number	Collected by	Location Description
1	KDHE[a]	On Mill Creek at bridge on Highway 10 at Zarah, Kansas, river mile 3.4, several miles from the study area.
2	KU[b]	On Little Mill Creek near the confluence of Mill and Little Mill Creeks.
3	KU	On Mill Creek near 90th Street
4	KU	On Mill Creek near 95th Street
5	KU	On Mill Creek near 111th Street, about 2 miles downstream from the Harold Street wastewater treatment plant.
6	KDHE	On Cedar Creek at bridge on Highway 10, 4.5 miles east of DeSoto, at river mile 0.4, also several miles downstream from study area.
7	KU	On Cedar Creek about 1/2-mile south of Highway 10.
8	KU	On Cedar Creek at 107th Street, about 2 miles downstream from the confluence of Cedar and Little Cedar Creeks.
9	KU	On Little Cedar Creek at 119th Street, about 1-1/2 miles downstream of Leeview Estates wastewater treatment plant.
10	KU	On Cedar Creek at 127th Street, about 1-1/2 miles downstream of Olathe Lake.

[a] Kansas Department of Health and Environment
[b] University of Kansas
Source: Ref. (24, 39)

The low DO levels usually occur during the summer months, when the water temperatures are higher and flow volumes are low. The DO saturation point decreases as temperature increases (40). Since the DO standard is violated in both Cedar and Mill Creeks, even though only one small sewage treatment plant discharges to Cedar Creek, while four relatively large plants discharge to Mill Creek, it seems likely that temperature is the predominant parameter influencing DO levels. However, the rate of aerobic decomposition of organic material increases as the temperature rises, requiring more oxygen, and is thus also a contributing factor to DO depletion.

The data also indicate that the quality of Cedar and Mill Creeks is fairly similar, except for nitrogen and phosphorus levels, which are considerably higher in Mill Creek. Nitrogen and phosphorus are two essential nutrients that affect the productivity of fresh waters (24). However, too much of these nutrients can lead to over-enrichment of aquatic plant life, such as algae. When these plants die, their decomposition depletes the DO content of the stream. The data also indicate that the quality of Little Cedar Creek is not significantly different from that of Cedar Creek.

d. Groundwater Quality. Olathe maintains eight wells in the Kansas River basin, several miles north of the study area. The groundwater is hard [150-300 mg/l as $CaCO_3$ (41, 42)]; therefore, Olathe softens its well supplies.

13. Aquatic Ecology

Only one percent of the study area is water. Standing-water ecosystems are rare in the region, and occur primarily as man-made impoundments, such as Olathe Lake (190 acres), Cedar Lake (77 acres), and farm ponds. The aquatic habitats of primary concern are Cedar and Mill Creeks and their tributaries.

Cedar and Mill Creeks are typified by relatively uniform stream and bank characteristics. Both have limestone beds, and channels containing small shallow riffles, short runs, and long pools that average 3 to 6 feet deep. Stream widths are from 3 to 9 feet in riffle areas, and from 15 to 25 feet in the pools. While the physical aspects of the creeks are similar, the available water quality data indicate that the streams are different. Physiochemical samples taken indicate that Mill Creek contains more phosphates, nitrates, and ammonia nitrogen than Cedar Creek. The values of biochemical and chemical oxygen demands were also higher in Mill Creek during a 24-hour study. This combination of parameters suggests that Mill Creek is somewhat more organically enriched than Cedar Creek; probably because it receives the effluents of four sewage treatment plants, while Cedar Creek receives treated sewage from only one small plant (24).

a. Benthic Community. Benthic macroinvertebrate populations in the project area streams were assessed at stations 2-5 and 7-10, as shown on Figure 11 and listed in Table 3. Two random samples were taken from riffle areas at each station in December of 1977, April of 1978 and July of 1978. A total of 22 taxonomic groups and 26,582 individuals were collected from Mill Creek (see Table B-6, in Appendix B). In comparison, 38 different taxa, totaling 17,852 individual organisms, were obtained in Cedar Creek (see Table B-7, in Appendix B) (24). Mill Creek thus supports 43 percent fewer taxa than Cedar Creek.

This data is more meaningful when the species diversity is examined. Simply stated, species diversity is the number of different species occurring in some location or under some condition. Diversity tends to be low in physically controlled ecosystems (i.e., subject to physiochemical limiting factors, such as oxygen) and high in biologically controlled ecosystems (i.e., limited by competition among species). This phenomenon is measured by ranking the species in a community on the basis of their numerical abundance. In a community that is stressed, there are relatively few species, with large numbers of individuals, because the environment has been made unsuitable for some species or has given some species a competitive advantage. Undisturbed environments support communities having large numbers of species with no individual species present in overwhelming abundance.

An aquatic community's diversity index is expressed in a decimal scale in which higher values indicate more desirable conditions. The Shannon-Wiener diversity index (117) indicates that Cedar Creek supports a more diverse aquatic macroinvertebrate community than does Mill Creek (Cedar Creek 2.6 and Mill Creek 2.1) (24). The water quality data (Section 12, this part) suggest that the lower diversity of Mill Creek may result from organic enrichment by the nutrients in the effluents of the sewage treatment plants in the Mill Creek watershed. This suggestion seems valid because benthic organisms show different ranges of physiological tolerance to various degrees of pollution. Some species have delicate respiratory mechanisms and respond adversely to low dissolved oxygen and high concentrations of ammonia nitrogen. Organic enrichment also indirectly affects benthos by disturbing reproduction, removing a food source, or altering their preferred habitat.

The community structures of Mill and Cedar Creeks were also analyzed by comparing the macroinvertebrates for which water quality tolerances to organic pollution have been documented (see Table B-8, in Appendix B). Cedar Creek contained 6 different taxa which were intolerant species, while Mill Creek had none. Also, 6 of the facultative taxa in Cedar Creek were not collected in Mill Creek. Four of these were stonefly species (Plecoptera). While classified as facultative, they may be too sensitive to survive the mild pollution associated with Mill Creek.

Most invertebrates inhabiting lakes occur in the littoral zone. Organisms found here include mites (Hydracarina), seed shrimps (Crustacea, Ostracoda), copepods (Crustacea, Copepoda) water fleas (Crustacea, Cladocera), and worms (Annelids, Oligochaeta) (90). Copepods and especially water fleas are major food sources for fish. Water fleas may account for as much as ninety-five percent of the stomach contents of young fish (44).

b. Fish Community. Fish collected with the aid of rotenone poisoning at one station each in Cedar and Mill Creeks yielded a total of 592 fish, representing 25 species (24) (see Table B-9, in Appendix B). This list is probably not complete due to the limited sampling effort. The most abundant species taken were those of the Prairie Faunal Region (44). Fish in this region are generally less diverse than in other regions because prairie streams are subject to widely fluctuating environmental conditions, and only fish tolerant of these fluctuations can persist. The majority of the species collected were forage fish belonging to the minnow family (Cyprinidae).

The fish of Cedar and Olathe Lakes include most of the common lake fishes, and are listed in Table B-11, in Appendix B (45). Channel catfish is the only species stocked with any regularity in Olathe and Cedar Lakes (46). Rare, threatened, and endangered species are discussed in Section 14 of this part.

c. Plant Community

1) Plankton. Plankton occur in the pools and sluggish sections of Cedar and Mill Creeks and the areas of open water of Cedar and Olathe Lakes. Phytoplankton (photosynthetic plankton) are generally more abundant than the zooplankton (animal plankton). Diatoms are usually the dominant group in the phytoplankton, and rotifers typically represent the most abundant zooplankton (47).

The headwaters of Cedar and Mill Creeks and their tributaries, being intermittent, probably contain a low diversity of true plankton, having instead an assemblage of detached and drifting organisms. These drift organisms are an important source of food for benthic invertebrates and some fishes.

2) Vascular Plants. Available data regarding aquatic vegetation in eastern Kansas is very limited. In addition to the many species of grasses, rushes, and sedges, Table B-10, in Appendix B, lists plants commonly found in and along streams, and either free-floating on, or in the littoral zone (the shallow-water region where light penetrates to the bottom) of, lakes (48).

14. Unique Biological Resources

a. Threatened and Endangered Species. While there are no endangered species recognized by the Kansas Fish and Game Commission known to inhabit the project area, two threatened species may occur (27, 28, 30, 46, 49, 50). These are the Topeka shiner (*Notropis topeka*) and the northern crawfish frog (*Rana areolata circulosa*) (30). Neither species has been collected in the Cedar or Mill Creek watersheds.

Federally protected Kansas plant species are those endemic to virgin prairie. Since this plant community is virtually non-existent in the study area, their occurrence is doubtful. The only endangered wildlife species that could conceivably inhabit the vicinity is the Indiana bat (*Myotis sodalis*). This species would be found in the study area only during the summer months, singly or in small groups, in hollow trees or beneath loose bark. Its distribution is associated with the major cave regions, where it hibernates. Since this region lacks the proper winter habitat, its range is at best peripheral and seasonal in the vicinity.

b. Ernie Miller Park. The City of Olathe originally purchased the 113-acre Ernie Miller Park in December, 1966, with a Federal matching grant ($23,750) from the Department of Interior Bureau of Outdoor Recreation (BOR) under the Land and Water Conservation Fund Act (L&WCF) of 1965. The land lay idle until the City sold it, with State and BOR approval, to the Johnson County Park and Recreation District (JCPRD) in early 1973, for $54,770. JCPRD designated Ernie Miller Park as a nature park.

JCPRD and the Youth Conservation Corps have developed several nature trails, foot bridges, etc., over the past few years, and there are plans to construct a nature center and other features to enhance the park's use. A map of the park's facilities and a copy of the park rules are included in Appendices A-2 and A-3, respectively.

In December, 1976 JCPRD was notified of the plans for a sewage system by the City of Olathe. All alternatives considered proposed a major interceptor along Little Cedar Creek, through the center of the park area. Opposed to the interceptor, the JCPRD contacted the State and BOR for assistance. BOR responded on January 7, 1977, stating that, under the provisions of Section 6(f) of the L&WCF Act, lands acquired or developed with L&WCF assistance cannot be converted to other than outdoor recreation use without the approval of the Secretary of the Interior. The Secretary's decision is normally based on recommendations of the BOR, and the BOR would not recommend approval of a conversion over the objections of the JCPRD. In July and August, 1977, the City and the JCPRD negotiated an easement agreement (see Appendix A-4) through the park that contained several restrictions designed to relieve the impacts of building the sewer. However, the BOR stated on November 29, 1977, that granting the easement would still have a detrimental effect on the park.

If a conversion is approved, there must be substitution of lands of equal value and recreational utility. A letter from the BOR to the EPA on April 5, 1978, stated that replacement property cannot be acquired in advance of a conversion request, because its use as a replacement property would then amount to a rededication of public land. However, replacement property should be approved by the BOR before it is acquired. Although the most appropriate replacement land may be adjacent to Ernie Miller Park, it need not be, if it is in a reasonably equivalent location. Until all alternatives and methods to mitigate the effects of the proposed sewer line on the park are examined, the BOR cannot make a determination as to how much replacement land would be required. At a minimum, the BOR would require that land equivalent to the permanent easement be replaced.

Ernie Miller Park contains an outstanding bottomland woodland consisting of young to mature (80-100 year old) bur and black oak, and lesser stands of black walnut, hackberry, silver maple and American elm. Little Cedar Creek, an intermittent stream, meanders through this area. An oak-hickory association is found on the upland sections of the park, and is comprised of several species of upland oaks and hickories, plus lesser stands of elm, ash and locust. The park also supports a diversity of herbaceous species (51).

It is thought that the forest is not native, but invaded the area following alteration of the grasslands by man or fire (52). Man's influence can still be observed in the form of an abandoned railroad right-of-way (circa 1890s) and an old homestead. Most of the railroad alignment has been overgrown by a mixture of small trees and brush on the north end, and by a more mature forest in the south section; however, the earth berms that border its 20-25 foot wide corridor are still apparent. These past impacts do not diminish the present aesthetics, function or ecology of the park. It is utilized by the Olathe School System as a biological study area, and by others interested in nature study, hiking and photography.

Although similar bottomland woodlands can be found in the Cedar Creek watershed and elsewhere in Johnson County, they are mostly privately owned, and are not accessible to the general public. A major part of the value of the park lies in its proximity to the City of Olathe (in the City Limits, less than two miles from the center of town). If present growth trends continue, the value of Ernie Miller Park as a natural area will increase.

B. MAN-MADE ENVIRONMENT

1. Population Characteristics

Rapid growth is the major characteristic of current population trends in the Olathe area. The expansion of the Kansas City Metropolitan Region (KCMR) southwest along the I-35 corridor caused Olathe to begin experiencing a steadily increasing rate of growth about 1971. Olathe's location within 20 miles of Kansas City, accessibility to major trafficways, proximity to various industrial communities, and position as the center of government in Johnson County are factors which have encouraged new suburban development in the Olathe area.

a. Current Population Trends. Growth has been rapid in Johnson County since before 1970, when it became the second largest county in

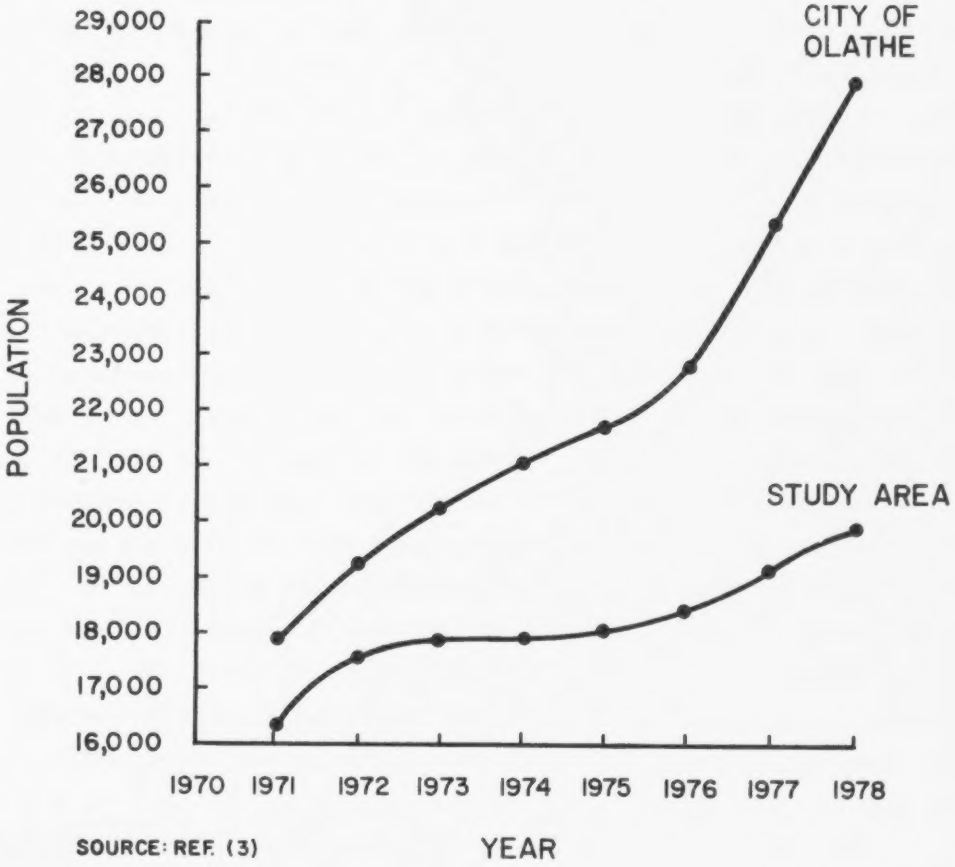
Kansas. Growth trends for the area are shown in the following table:

	1950*	1960*	1970*	1978**
Olathe	5,593	10,987	17,917	27,932
Overland Park (incorporated in 1960)	-	21,110	79,034	82,400
Johnson County	62,783	143,792	217,662	256,259

* (61)
** (3)

Between 1970 and 1978, the population of the City of Olathe increased 56 percent, from 17,917 to 27,932 persons. Johnson County experienced a slower overall rate of growth, 16 percent, during the same period. In 1978, Olathe became the second largest city in Johnson County (3).

In 1971, the total population of the study area was estimated to be 16,344 with 1,228 persons in the Upper Cedar Creek basin, 6,418 persons in the Little Cedar Creek basin, and 8,698 persons in the Mill Creek basin. Approximately 96 percent of the study area population was within the city limits of Olathe. The study area population growth since 1971 does not reflect the recent expansion of Olathe (see Figure 12) because most of the new residential development has occurred east of Interstate 35, outside the study area. The Mill Creek basin and the eastern portion of the Little Cedar Creek basin are the only parts of the study area that show significant population increases since 1971. The current (1978) estimate of study area population is distributed as follows: 2,200 in the Upper Cedar Creek basin, 7,400 in the Little Cedar Creek basin and 10,360 in the Mill Creek basin. Approximately 94% of the current study area population is within



SOURCE: REF. (3)

FIGURE 12
ESTIMATED POPULATION HISTORY, 1971-1978

Olathe's city limits, concentrated in the Mill Creek basin and the eastern portion of Little Cedar Creek basin.

In general, the nature of study area population can be described as urban in the Mill Creek basin and in eastern Little Cedar Creek basin. There is some suburbanization in the western Little Cedar Creek basin and in Upper Cedar Creek, but the majority of the population is scattered in rural areas.

b. Population Projections. Population projections developed by the Mid-America Regional Council (MARC) in 1971, and updated in 1975, are the source for the population projections in this EIS. The methodology used by MARC in the projection process is as follows: (1) regional projections were obtained through the cohort-survival method, which measures the effects of natural increase, decrease and migration on future population levels; (2) regional totals were disaggregated (broken into component parts) into urban and rural areas of the region; (3) urban and rural totals were further disaggregated into smaller transportation zones. The projections for the study area, presented in Table 4, were obtained by estimating what proportion of the population projected by MARC for the transportation zones would also be included in the study area (55). The projections assume that services, such as sewerage, water supply, and police and fire protection will continue to be made available as needed, according to the type of area being projected. Full municipal services were assumed for urban areas; septic tanks and wells for rural areas.

Current estimates of the Little Cedar Creek basin population for 1978 equal the MARC projection for Little Cedar Creek basin in 1980, an indication that the MARC projections may be low (55, 56). Therefore, these projections should be viewed as general indications of population growth, and not as definitive predictions.

TABLE 4

STUDY AREA POPULATION PROJECTIONS

	1978	1980	1990	2000
Upper Cedar Creek Basin	2,200	2,600	4,600	7,200
Little Cedar Creek Basin	7,400	7,400	11,000	15,400
Sub-Total	9,600	10,000	15,600	22,600
Mill Creek Basin	10,360	12,900	16,200	20,400
Total	19,960	22,900	31,800	43,000

The inner core of Kansas City has been decreasing in population density due to the more recent emphasis on suburban low-density residential development. This movement of population from the inner city is the major reason for Olathe's recent accelerated growth rate. Future population growth will continue to occur in the suburban areas of the KCMR, and suburban land use is expected to increase by 30% by the year 2000 (57). The center of population in Johnson County has been moving south and west toward the communities of Olathe and Lenexa, and the 1990 center of population is projected to be near the northeastern corner of Olathe (56).

Ultimate Development. Ultimate development populations within the planning area are shown in Table 5, below.

TABLE 5

STUDY AREA PROJECTED ULTIMATE POPULATION

Upper Cedar Creek	72,400
Little Cedar Creek	36,200
Mill Creek	17,900
Total	126,500

These figures are based on current population densities (per developed acre) and the number of existing undeveloped acres within each basin. They assume that every acre which could be developed will be developed at some distant point in time.

2. Land Use

The existing and future land use maps were developed based on 1973 MARC land use maps, a 1979 City of Olathe zoning map, and the 1976 Olathe Comprehensive Plan. These maps indicate general areas of land use; individual land uses at specific sites should not be assessed from these maps. Existing and future land use acreage and density figures were based on MARC population and land use projections and Olathe's Comprehensive Plan.

a. Existing Land Use. The planning area includes 15,800 acres in the Upper Cedar Creek basin, 7,600 acres in the Little Cedar Creek basin, and 3,600 acres in the Mill Creek basin, of which approximately 1,320 acres (8 percent) in Upper Cedar Creek, 1,290 acres (17 percent) in Little Cedar Creek, and 1,320 acres or 37 percent in Mill Creek are developed. About two-thirds of the total study area is presently unincorporated. Figure 13 shows that the study area's development density increases from west to east. The vast majority of development is concentrated within the Olathe city limits, in the Little Cedar Creek and Mill Creek basins.

TABLE 6

EXISTING LAND USE

	Upper Cedar Creek Acres	Little Cedar Creek Acres	Mill Creek Acres
Residential	520	640	840
Public/Semi Public	500	450	180
Light Industrial/ Commercial	300	200	300
Undeveloped*	14,480	6,310	2,280
Total	15,800	7,600	3,600

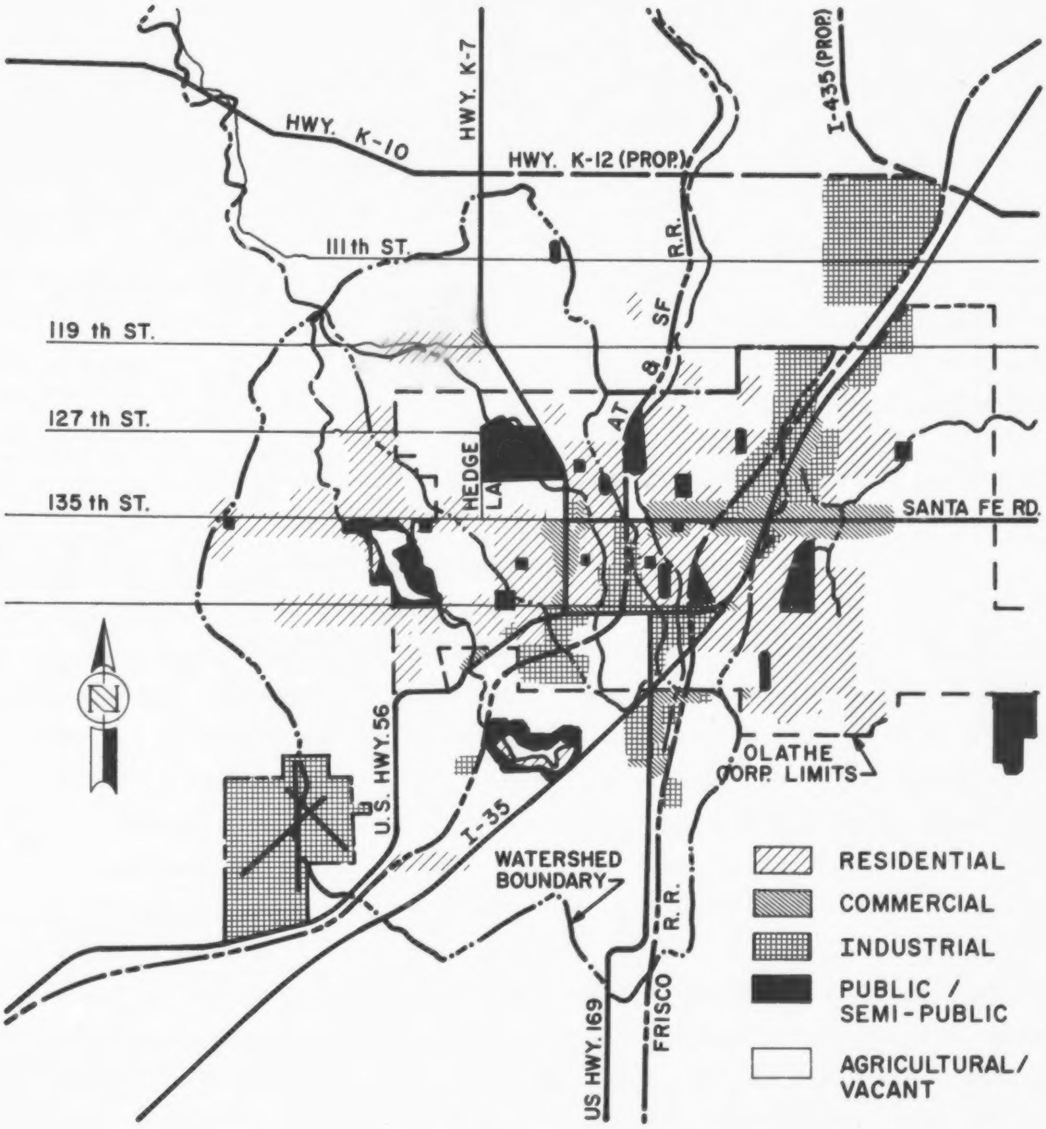

HWY. K-10
HWY. K-7
HWY. K-12 (PROP.)
I-435 (PROP.)
111th ST.
119 th ST.
127 th ST.
135 th ST.
SANTA FE RD.
HEDGE LA
AT & SF R.R.
U.S. HWY. 56
I-35
WATERSHED BOUNDARY
OLATHE CORP. LIMITS
US HWY. 169
FRISCO R.R.
N
RESIDENTIAL
COMMERCIAL
INDUSTRIAL
PUBLIC / SEMI-PUBLIC
AGRICULTURAL/ VACANT

FIGURE 13
EXISTING LAND USE

TABLE 6 (Cont.)

DENSITY FIGURES

Population	2,200	7,400	10,360
Dwelling Units	690	2,550	3,660
Persons/Unit	3.19	2.90	2.83
Persons/Acre	.14	.97	2.88
Persons/Residential Acre	4.23	11.56	12.33
Persons/Developed Acre	1.67	5.74	7.85
Units/Acre	.04	.34	1.02
Units/Residential Acre	1.33	3.98	4.36

*includes streets, rights-of-way and agricultural land uses.

The largest portion of the study area is devoted to agricultural uses, but these areas are rapidly diminishing due to increases in residential land uses. Table 6 shows that residential land uses dominate the developed land in the study area. Residential development, in the form of single-family units grouped in subdivisions, is concentrated within the city limits of Olathe. In the portions of Little and Upper Cedar Creek basins outside the city limits, residential development tends to be scattered along county roads. The housing units per residential acre figures reflect moderate housing density in the Mill Creek and Little Cedar Creek basins, and low housing density in Upper Cedar Creek basin. Multi-family housing is located in the more urban sector of the study area, in the Mill Creek and southwestern Little Cedar Creek basins, within the city limits. This is reflected in the lower persons per housing unit figures for those areas.

In the study area, most new residential development has occurred within the city limits of Olathe. The amount of new residential development within this area has been relatively low compared to that taking place east of I-35, where the population has approximately tripled since 1971 (3). There are signs, however, that this trend is changing. In recent years, construction of single-family units has increased west of K-7, primarily in the area between 127th Street and 135th Street. In the county, about 1 mile west of K-7 along 119th Street, there are several groups of homes under construction, and additional land is for sale. Development in this area is limited, due to the wooded, hilly topography and the difficulty of providing public services.

There are several reasons for the increased construction activity west of K-7. One reason is the comparatively lower price of land; developers are able to purchase land at lower prices because it lacks convenient access and proper utilities. Another reason is the decreasing supply of developable land east of I-35. Most of the demand for residentially developable land to date has occurred east of I-35. Although vacant, residentially developable land still exists east of I-35. However, it is unsewered, and it is unlikely that this service will be made available in the near future. The Indian Creek treatment plant is currently approaching capacity, and the vacant land northeast of the plant cannot be served by gravity. A sewerage improvements study has been recently initiated on this watershed, but, because of the length of time involved in such studies, construction or expansion of facilities in this watershed will not occur for some time. The other potentially developable land east of I-35 is in the Tomahawk Creek watershed, in the southeast corner of the city. This land is unsewered, and there are presently no plans to provide this service. In addition, city leaders are placing a definite emphasis on achieving geographically balanced residential growth in Olathe. It is their general opinion that a substantial amount of additional growth in eastern Olathe will result in increased traffic on already congested thoroughfares, and other access problems (62).

Because of the overloading of the city's major sewage treatment facility at Harold Street and several of its tributary lift stations, the State restricted sewer extensions in the Little Cedar and Upper Cedar Creek basins from April, 1978 to September, 1979, when a holding basin was constructed at the Prairie Center lift station (63, 114). Some developers built temporary treatment facilities in order to begin construction. The Lakestone Estates, Leeview Estates and Persimmon Hill subdivisions are examples of areas served by local treatment facilities. In other cases, the restriction was an impediment to residential development. According to City policy, a property owner whose undeveloped property is adjacent to an existing sewer main may be taxed for the service, but is not guaranteed the right to connect to that main (64). The Saxony, Prairie Trail, and Cliffview West subdivisions are platted, approved developments where construction is being restricted until public sewers become available.

Santa Fe Road and I-35 are the major corridors of light industrial/ commercial development in the study area (see Figure 13). Light industrial development is concentrated along I-35, especially in northeastern Olathe, where I-35 enters the city, and in southern Olathe, where U.S. 56 and I-35 branch. There are over 700 industrially-zoned acres in southern Olathe, a large portion of which is undeveloped, unsewered land owned by the Santa Fe and the Frisco railroads, who have no immediate plans to develop the land (65). The only other major industrial land use in the study area is the Johnson County Industrial Airport, which is partly included in the southwestern portion of the Upper Cedar Creek basin, along U.S. 56, and which is in the initial stages of development as a light industrial park.

Most large shopping centers and office parks are outside both the study area and Olathe, in Overland Park and Lenexa, just northeast of the city. Two examples are the large J. C. Penney Distribution Center and the Corporate Woods Office Park, to which a substantial number of Olathe residents commute (62). Olathe's central business district is centered around Santa Fe Road, and represents the highest concentration of commercial land uses in the study area.

b. Future Land Use. Table 7 and Figure 14 show the projected land use in the study area, based on a continuation of current trends and local policies.

Approximately 90 percent of the population growth projected for the study area will occur within, or immediately adjacent to, the city limits of Olathe. This residential sector growth will require approximately 2600 additional acres of land, most of which is now used for agriculture. Persimmon Hills is one major new residential development that is currently in the initial stages of construction. Located in the northwest corner of Olathe, along Prairie Center Road (135th Street), it is planned to eventually include approximately 2,500 assorted single-family, duplex, and multi-family units. Large scale residential development is also likely to occur north of the city, in the Little Cedar Creek basin. A connection between K-10 and I-435 will be built in the future, providing needed access to Kansas City from western and northern parts of the study area (68). A fairly small amount of residential development is predicted for the southern Upper Cedar Creek basin. Population density for all of Upper Cedar Creek is expected to remain at less than one person per acre through

TABLE 7

FUTURE LAND USE - DENSITY FIGURES

	Upper Cedar Creek	Little Cedar Creek	Mill Creek
Total Acres	15800	7600	3600
Residential Acres	1285	1480	1840
Dwelling Units	2570	5925	8000
Population	7200	15400	20400
Persons/Unit	2.80	2.60	2.55
Persons/Acre	.46	2.03	5.67
Person/Residential Acre	5.60	10.41	11.09
Persons/Developed Acre	5.00	5.74	7.85
Units/Acre	.16	.78	2.22
Units/Residential Acre	2.00	4.00	4.35

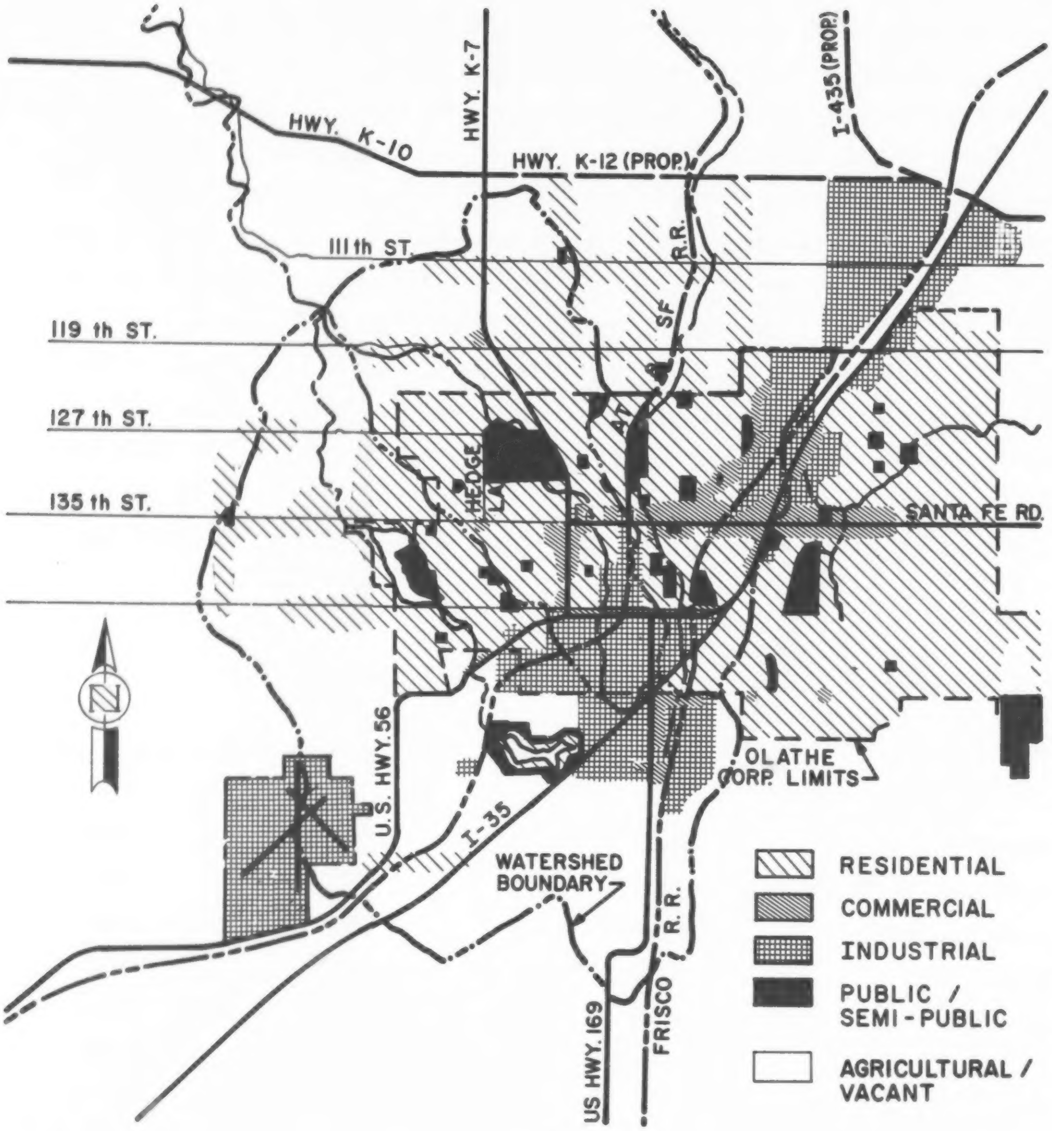

HWY. K-10
HWY. K-7
HWY. K-12 (PROP.)
I-435 (PROP.)
111th ST.
119 th ST.
127 th ST.
135 th ST.
SANTA FE RD.
SF R.R.
AT
HEDGE LA.
N
OLATHE CORP. LIMITS
U.S. HWY. 56
I-35
WATERSHED BOUNDARY
US HWY. 169
FRISCO R.R.
RESIDENTIAL
COMMERCIAL
INDUSTRIAL
PUBLIC / SEMI-PUBLIC
AGRICULTURAL / VACANT

FIGURE 14
FUTURE LAND USE

the year 2000 (55). The amount of residential development in this area will depend on the ability of the Johnson County Industrial Airport to attract businesses and stimulate employment.

Olathe's Comprehensive Plan stresses the need to attract industry and business to maintain the city's image of an independent, full-service community. If this is accomplished, most of southern Olathe (in the Mill Creek and Upper Cedar Creek basins) will be devoted to industrial uses as shown in Figure 14. This will be most likely to happen if the railroads develop their holdings into industrial parks. The possibility exists, however, that the railroads would sell their holdings to other developers for residential use (65). Also, the recent trend has been for industry to locate at the Johnson County Industrial Airport, which is outside the corporate limits. These two factors may act against the efforts of the city to attract new industry and business.

Commercial growth within the study area is not expected to be large. Several shopping centers are included in the Olathe Comprehensive Plan, one of which is to be in the Little Cedar Creek basin at the junction of Prairie Center Road and Hedge Lane, near Persimmon Hills (72).

c. Comprehensive Plans and Zoning Ordinances. The City adopted a Comprehensive Plan in June of 1978. This plan indicates the desired pattern of future land uses, and includes a set of policies regarding urban growth and development. The Comprehensive Plan recommends that urban development in the Cedar Creek watershed should not be encouraged until after 1980. In addition, one of the policy statements reads:

> It shall be the policy of the City of Olathe that no final plat or final development be approved nor shall property be rezoned for any urban use in the Cedar Creek or Mill Creek watersheds unless binding arrangements are made assuring that no development will occur until adequate liquid waste facilities are constructed by the City. An alternative may be approved in certain cases where the configuration, location, and size of land area would permit construction of an efficient interim treatment facility. In addition, plats may be approved for large lot single family subdivisions, where septic

> tanks and lateral fields are to be used for liquid waste disposal, provided such subdivisions are so located that contamination of surface or ground water will not occur (64).

The City's zoning ordinance uses "District A," the agricultural district, as a base zone. Land within this district is either undeveloped or agricultural, and the minimum lot size per one-family dwelling unit is 15,000 sq. ft. The large majority of residential development occurs in the residentially-zoned districts, which require a minimum lot size per one-family dwelling unit of only 7,200 sq. ft. This is the major reason for the fairly dense residential development within the city. The ordinance also allows for "Planned Residential Districts," of which Persimmon Hills is an example.

The Johnson County Community Development Office is developing a county-wide zoning ordinance and Comprehensive Plan. Currently, there is no Comprehensive Plan for the unincorporated land in the Upper Cedar Creek basin. There are existing zoning procedures, but they are very general and antiquated. Some of the goals of the new zoning ordinance and Comprehensive Plan are to maintain the minimum lot size per family, which is currently 15,000 sq. ft.; to ensure adequate water supply and fire protection; to protect agricultural acreage by providing incentives to farmers not to sell their land to subdividers; and to establish geographical control over urban growth. The deadlines for completion are January 1, 1980 for the county zoning ordinance, and 1982 for the Comprehensive Plan (74).

3. Economic Conditions

a. Employment Sectors. Most employed persons living in Olathe work outside the city, although there is some commercial and light industrial development located along I-35 and directly south of the city center. The distribution of employment by major economic sector for both Johnson County and the entire KCMR is shown in Table 8. While the industrial sector accounts for the greatest percentage of

TABLE 8

Employment by Economic Sector
Johnson County and KCMR
1970-2000 Projected

Economic Sector	1970 Jo. Co.	1970 (%)	1970 KCMR	1970 (%)	1980 Jo. Co.	1980 (%)	1980 KCMR	1980 (%)	2000 Jo. Co.	2000 (%)	2000 KCMR	2000 (%)
Agriculture	1,946	(3.2)	9,992	(1.8)	1,594	(2.0)	8,052	(1.2)	1,480	(1.1)	7,100	(0.8)
Mining	151	(0.3)	730	(0.1)	86	(0.1)	500	(0.1)	81	(0.1)	474	(0.1)
Industry[1]	22,807	(37.9)	237,000	(41.8)	29,822	(36.8)	279,489	(40.2)	54,248	(41.3)	366,928	(39.1)
Retail Trade	12,243	(20.4)	87,158	(15.4)	16,419	(20.3)	109,855	(15.8)	27,391	(20.8)	149,259	(15.9)
Services[2]	8,417	(14.0)	106,768	(18.8)	14,909	(18.4)	141,963	(20.4)	22,552	(17.2)	202,038	(21.5)
Government	7,690	(12.8)	68,582	(12.1)	9,192	(11.3)	89,189	(12.8)	13,306	(10.1)	134,338	(14.3)
Unclassified	6,855	(11.4)	56,598	(10.0)	8,984	(11.1)	66,277	(9.5)	12,370	(9.4)	78,694	(8.4)
Total	60,109	(100.0)	566,828	(100.0)	81,006	(100.0)	695,323	(100.0)	131,428	(100.0)	938,831	(100.1)

1. Includes Construction, Manufacturing, Wholesale Trade, Transportation, Communications, Public Utilities
2. Includes Services, Finance, Insurance, Real Estate

Source: Ref. (55).

employment, it is a lower percentage in Johnson County than in the KCMR. The difference is offset by a higher percentage of retail trade in Johnson County than in the KCMR. The relative distribution of employment in the county is projected to remain fairly stable through the year 2000.

b. Study Area Economic Activity. The study area is predominately rural in character, although considerable residential development is planned. Some industrial activity is evident in the southern part of the area, where the Johnson County Industrial Airport has been operating for approximately three years. Twenty-five firms, employing approximately 1,600 personnel, are located in this light industrial complex. An additional 350 employees expected within the next year (75). The Industrial Airport provides water and sewer services for its tenants.

Additional industrial and commercial activities are located within the corporate limits in the southern part of the Little Cedar Creek basin. This is the location of Delco-Remy and Southwest Grease, the largest employers in Olathe. Two railroad firms have plans for industrial parks in the area, but development is being delayed, partially due to lack of adequate sewer capacity.

Within the Olathe area, approximately 3,100 new jobs have been added in the past 3 years. Although the majority of these jobs are held by persons from outside the immediate area, the unemployment rate in Olathe is estimated to be only 3.4 percent (76). A significant amount of the industrial growth of the KCMR is occurring in the I-35 corridor to the southwest, and as this trend continues, employment in the Olathe area will continue to show strong gains.

c. Personal Income. The median household income in Olathe is estimated to be $19,471, or $6,328 per capita (77). This figure is slightly lower than the average for Johnson County; however, the county has consistently had the highest median family income in the KCMR, and in 1969 had the fifteenth highest in the nation (77).

In 1977, the percentage of Johnson County households with effective buying incomes less than $8,000 was less than half of the overall percentage for the KCMR, and only one-third of the Kansas state average. Likewise, the percentage of households with effective buying incomes of over $25,000 in Johnson County (over 43 percent) was nearly double the overall KCMR rate. In spite of this relative affluence, Johnson County also has the fourth highest number of families with incomes below the poverty level of the 105 counties in the state (78).

4. Archaeological, Historical, and Recreational Resources

a. Cultural Resources Survey Techniques. A cultural resources reconnaissance survey of the planning area prepared under subcontract by the Anthropology Department of Wichita State University covered approximately 30% of the total area, concentrating most heavily in localities threatened by direct impact. Since local collectors and farmers have gathered many surface artifacts, and a substantial portion of the ground was covered with dense vegetation that limited surface visibility, a multi-faceted approach was used. The combination of intensive pedestrian survey (3.3% of total acres), shovel tests, vehicular survey, informant and collector interviewing, aerial photography, and archival research is believed to have identified close to 80% of the resources recognizable from the ground surface. Limited test excavations were performed when an archaeological site was near proposed construction activity and either diagnostic artifacts or knowledge of the site's vertical dimension were lacking.

b. Archaeological Resources. Cultures represented by artifacts collected in the planning area date from the Late Archaic Nebo Hill hunters and gatherers (perhaps 5,000 years ago) through Plains Woodland and Pomona to historic Euroamerican. Twenty prehistoric archaeological sites, five of which may qualify for inclusion on the National Register of Historic Places, and eight others which may qualify for inclusion on the Kansas Inventory of Historic Sites, were identified. Most of these are along the Upper Cedar Creek Valley and are part of a larger concentration of sites extending northward along the valley, beyond the planning area.

Criteria for inclusion in the National Register of Historic Places are found at 36 CFR 60.6. To qualify for inclusion, a site must possess the qualities of significance in American history, architecture, archaeology, and culture, and integrity of location, design, setting, materials, workmanship, feeling, and association. The site must also:

1) be associated with events that have made a significant contribution to the broad patterns of our history; or
2) be associated with the lives of persons significant in our past; or
3) embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or
4) have yielded, or be likely to yield, information important in prehistory or history.

Criteria for inclusion on the Kansas Inventory of Historic Sites are similar to the national standards, except that the requirement of integrity is not as strictly enforced if the site is locally significant.

All five sites that are potentially eligible for National Register status are in the Cedar Creek basin, and have been damaged by past farming activities. However, artifacts were recovered below the deep plow zone. Site 14J0505 had four different occupation periods: Nebo Hill, Plains Woodland, Pomona, and historic Euroamerican. Cultural materials at site 14J0507 suggest prolonged Plains Woodland occupation, or a series of short occupations. Later Pomona occupation may also have occurred. The size of Site 14J0514 and its distinctive tool assemblage, which is tentatively identified as belonging to the poorly-known Plains Woodland culture, are the bases for its potential eligibility. Site 14J0515 indicates a multicomponent site, with Plains Woodland and Pomona occupations. Materials from this site may be significant to two important hypotheses - 1) the possible development of the Pomona culture from the Plains Woodland, and 2) differences between, and possible interaction of, the Plains Woodland and Kansas City Hopewell cultures. The size, undisturbed deposits, and possible multicomponent, stratified nature of Site 14JO521, which may have been occupied by the Nebo Hill, Plains Woodland, and Pomona cultures, make this site potentially valuable.

c. Historical Resources. Historical resources identified in the planning area fall into two general groups: 1) sites and buildings associated with the Santa Fe Trail and 2) buildings and sites connected with the establishment and development of the present-day City of Olathe. Twenty-nine historic buildings were noted, including the J.B. Mahaffie House, which is listed on the *National Register of Historic Places*. Seven additional buildings are on the state *Inventory of Historic Sites*.

Twelve other historic locations were identified. These include three short segments of the Sante Fe Trail, all southwest of the city. These are considered valuable because little else remains of the Santa Fe Trail in eastern Kansas due to farming activities and urbanization. Other historic sites include the Old Calamity Railroad bed, the Abbott sidewalks, and the Lone Elm Campground.

d. Recreation Resources. There are a total of 611 city-owned acres devoted to recreational uses in the study area, of which 507 are in the Olathe and Cedar Lake recreation areas. The remaining 104 acres are in various types of local parks. Table 9 lists each park or recreation center and the activities available at that facility.

Olathe and Cedar Lakes, which represent 83 percent of the total recreational acreage, are the major recreational areas in the study area. These two lakes, along with the South Frisco Lake Park and the Waterworks Park, are recreational centers offering water-related activities such as fishing and/or boating. The only park with a City swimming pool is Mill Creek Park. The rest of the recreational areas are local parks, which have a variety of facilities such as ballfields,

TABLE 9
RECREATION FACILITIES

Upper Cedar Creek Basin

1. Olathe Lake - 378 acres, 190 acres water; swimming, golfing, fishing, boating, picnic shelters, duck hunting.
2. Cedar Lake - 129 acres, 77 acres water; swimming, fishing, non-power boating, picnic shelters, volleyball courts, camping.

Mill Creek Basin

3. Mill Creek Park - 5 acres; swimming pool, free wading pool, lighted tennis courts, playgrounds, picnic tables.
4. Havencroft - 9 acres (neighborhood school/park); tennis courts, ballfield, game courts, playground, picnic tables.
5. South Frisco Lake Park - 23 acres, 12 acres water; fishing, playground, picnic shelter, ice skating in season.
6. Waterworks Park - 29 acres, 14 acres water; fishing, jogging - bicycle trail, picnic tables, playground, basketball court.
7. Two Trails Park - 18 acres; lighted ball diamonds, lighted tennis courts, football field, playground.

Little Cedar Creek Basin

8. Fairview Park - 1.65 acres; lighted tennis court, lighted basketball court, picnic shelter, playgrounds.
9. Rolling Ridge - 14 acres (neighborhood school/park); tennis courts, ballfield, game courts, playground, picnic tables.
10. Naval Air Park - 4 acres; hiking trails, campfire sites.
11. Ernie Miller - 113 acres; hiking trails, campfire sites.

Ref. (68)

playgrounds, and picnic shelters. Two parks are on school sites, and represent a joint use of recreational facilities. One full-time Park Ranger supervises all activities in City parks. A number of recreational programs, such as team sports and hikes, are sponsored by the City's Parks and Recreation Department, and utilize City parks (68).

Ernie Miller Park is the only regional recreational area within the study area, and is under the jurisdiction of the Johnson County Park and Recreation District. The park is a 113-acre natural area, and its facilities include 3 miles of hiking trails and campfire sites. For a more detailed description of the park see Chapter II, Part A, Section 14, Unique Biological Resources. Additional regional recreational resources (professional sports, concerts, zoos, etc.) are available in Kansas City.

5. Transportation

Olathe is favorably located in relation to transportation facilities, and their availability will play a major role in determining both the rate and the location of growth within the study area.

a. Air. Commercial airline service is available at the Kansas City International Airport, about 40 miles north of Olathe. Air taxi and general aviation facilities are also available at Fairfax Municipal and Kansas City Municipal Airports, in Kansas City, and at the Johnson County Executive and Johnson County Industrial Airports, both within five miles of Olathe.

b. Rail. Olathe is served by three railroads, the Atchison, Topeka and Santa Fe (ATSF), the St. Louis and San Francisco (Frisco), and the Missouri, Kansas, and Texas Railway (Katy), which shares the Frisco tracks. The two sets of tracks are about a mile apart, and traverse the central part of town in a north-south direction. They have numerous at-grade street crossings, and are connected by an east-west spur in the southern part of the city. The ATSF operates 23 round-trip trains through Olathe each day (79), while the Frisco and Katy have 18 round-trip trains per day (80), for a total of 82 train-trips through town each day.

c. Water. The nearest barge facilities are at the Kansas City Harbor, on the Missouri River (81).

d. Automotive.

1) General. The street and highway system is the major carrier of goods and people. Interstate Highway 35 (I-35) is the principal traffic artery in the area, and allows direct access to Kansas City. The only major east-west street extending completely across the city is 135th Street, which is also designated as Kansas Highway 150 (K-150), Santa Fe, and Prairie Center Road. The principal north-south route in the project area is Kansas Highway 7 (K-7), which extends through town and borders Ernie Miller Park. Other major traffic routes in, or affecting, the project area include: Dennis Ave. (143rd Street); U.S. Highway 56; U.S. Highway 169; Kansas Highway 10 (K-10), which runs east-west a few miles north of town, and, with K-7, provides an alternate means of access to Kansas City; and 119th Street, which will become the access road to the proposed treatment plant.

Olathe has no municipal or commuter bus service. Continental Trailways has two buses per day that stop in Olathe.

Olathe has about 230 miles of streets. Fifty percent are in the Mill Creek basin, about 25 percent are in the Little Cedar Creek basin, and most of the rest are east of I-35, outside the study area. The City maintains very few streets in the Upper Cedar Creek basin (82). The Johnson County Engineer's Office has jurisdiction over 119th Street from K-7 west to the proposed treatment plant site, and maintains most of the roads in the Upper Cedar Creek basin and a few miles in the Little Cedar Creek basin, outside the city limits (83).

2) Problem Areas. Olathe's rapid growth has created several severe traffic problems. How these problems are handled will be a major factor in determining both the rate and the location of growth within the study area, and the area's subsequent need for sewerage facilities.

Most of Olathe's traffic problems are related to the city's dependence on K-150 as its main commercial street and primary means of access to I-35. Traffic is decidedly hampered by K-150 being the only east-west street extending completely across town; by there being very few through north-south streets; and by the total of 82 trains per day using the ATSF and Frisco tracks, causing severe traffic congestion, delay, and inconvenience at the many grade crossings throughout the city, especially on K-150.

The I-35 interchange with K-150 requires eastbound traffic wishing to go north to turn left across westbound K-150 traffic. Since about half the workforce living within the city limits works elsewhere, and over half the jobs in Olathe are held by people living outside the city (84), this conflict also causes much inconvenience.

To reach Kansas City or Overland Park, residents of the project area must either cross town on K-150 or Dennis Ave. (which does not have a convenient connection with I-35), or take the considerably longer route north on K-7 and east on K-10. Neither choice is very convenient.

119th Street has been vacated along Section 18 (83), west of the proposed treatment plant site, and is impassable to normal traffic for about half a mile east of the site. Two small concrete bridges over Little Cedar Creek along Section 17 have collapsed or been demolished, and the western half-mile along Section 17 is an overgrown dirt trail. Since the road's usefulness to rural residents is questionable, it is doubtful that the County would be willing to bear much of the cost of improving the road primarily to provide access to a City facility (83).

3) Planned Programs. The City constructs a few miles of new streets each year, but most of its street funds go toward maintaining and improving the existing street system. New streets are built primarily by subdividers and other developers, under the City's specifications and inspection, and are then turned over to the City for maintenance.

In 1977, the City developed a ten-year program to schedule needed street improvements. The plan relies heavily upon State and Federal programs for its implementation, which will probably delay its schedule considerably (82). The three projects most desired by the City are: construction of Kansas Highway 12 (K-12) from K-7 to I-435, together with completion of I-435 and interchanges on K-12 at Woodland Avenue and Ridgeview Road; improvement of the I-35 interchange at 119th Street, together with construction of a curved extension of Kansas Avenue to connect K-150 with the interchange; and improvement of the I-35 interchange at K-150 to a full or partial cloverleaf (84). The City believes that these projects will provide more convenient routes to Kansas City from northern and western Olathe, and will relieve much of the traffic congestion. More convenient access will also stimulate development in the study area, and assist in achieving the geographically-balanced growth desired by City officials.

Work is scheduled to begin on K-12 and I-435 in late 1979; however, K-12 will stop at Renner Road until at least 1985, and there will be only a limited connection to I-435 until 1988 or 1989. Similarly, the State has no plans for the I-35 interchange at 119th Street until after 1990, and no State or Federal funds are likely to be available for the Kansas Avenue extension. No major work is planned at the I-35 interchange with K-150 before 1990, either, and relocation and right-of-way costs necessitated by the proximity of development may make constructing a cloverleaf there financially infeasible (85).

Other desired projects for providing access to the study area include widening K-7 to four lanes from K-10 to U. S. 56, and constructing grade separation structures at the intersections of K-150 with the ATSF and the Frisco railways (84). The State plans to widen K-7 from 87th Street to the north city limits within the next 10 years, but this is a low priority project, and no work is planned from the north city limit to U. S. 56. The State currently has no money budgeted for railroad grade separation structures in Olathe, and the cost of necessary relocation and right-of-way acquisition for such improvements would probably prove prohibitive (85). Aside from limited maintenance work, the County has no plans for increasing access to, or traffic capacity in, the study area (83). Thus, for the next 10 years, transportation facilities in the study area will largely be limited to the existing road network, local streets built by developers, and such few new streets as the City is able to build with its own funds. To the extent that growth is dependent on convenient access to Kansas City, it will be limited by the traffic problems discussed above.

6. Resource Use

a. Mineral Resources. Minerals produced commercially in Johnson County include oil, gas, sand, gravel, and limestone. Their combined value in 1966 was $2,312,252 (86), $4,017,000 in 1972 and $4,638,000 in 1977 (87).

There are 10 designated areas of oil and gas production in Johnson County - of which two produce oil and gas, and eight produce gas only (86). An estimated 10 new oil and gas wells and dry holes were drilled in 1966 (88). In 1976 and 1977 there was no commercial production in Johnson County, and the records of gas and oil produced on wells leased to individuals were withheld by the U.S. Bureau of Mines (87). There are two natural gas fields in the study area. The Olathe field is between Ernie Miller Park and Olathe Lake. The Olathe North field is just north of the city limits, and extends under the proposed treatment plant site.

Building and paving sand, fill sand, filtration sand, and building gravel are dredged from the Kansas River or from pits in Kansas River valley alluvium in the northern section of Johnson County. Production figures were not available for this resource.

Limestone is the county's most important mineral resource in terms of dollar value, and the Wyandotte Limestone is the most commercially important geologic unit. The Wyandotte Limestone is very thick, gray to blue-gray, with a thin, dark gray shale seam. It has extensive distribution, and is exposed at the Olathe Lake spillway. The 1972 production of mineral resources ($4,017,000) was almost exclusively limestone, with lesser amounts of gravel and sand. In 1977, the production of crushed limestone, which is used for concrete aggregate, road stone, and agstone, was valued at $4,638,000; and limestone was the county's only commercially produced mineral (87). This ranked the county first in value of stone produced in Kansas (86). Limestone is present in the study area, but the amount, quality, and commercial value is unknown because none of it has been commercially developed to date.

Other mineral resources in the county include materials suitable for the manufacture of brick, tile, and construction aggregates, as well as a high quality silica sand suitable for use in the glass industries (86); but there is no known current utilization of these materials. There are no other commercially valuable minerals known to occur in the study area.

b. Commercial Forests. Forestry is a limited, but profitable, industry in eastern Kansas. In Johnson County, an estimated 27,700 acres, or 9.1 percent of the total land area, is productive timberland (89). Productive timberlands are those capable of producing marketable timber that is potentially available for harvest. Percentages of each major timber species are not available; however, the most profitable species, ranked in decreasing value include: black walnut, bur oak, hackberry, green ash, cottonwood and silver maple. While the project area has been previously logged, it still contains a considerable amount of merchantable timber, mostly in bottomland and cove areas.

c. Commercial and Recreational Wildlife. Several species of wildlife in the region afford recreation to hunters, trappers and bird watchers. Wildlife that is hunted includes upland game and big game. Upland game consists of cottontail rabbit, squirrel, dove, quail and prairie chicken. White-tailed deer is the only big game in the area

(118). Commercially important species sought by trappers include the striped skunk, bobcat, raccoon, opossum, red fox and gray fox (91). The number of furbearers taken and the value of the pelts harvested were not available. As a result of the rapidly growing interest in bird watching, all species of birds may also be considered recreationally important.

Since the Mill Creek basin is urbanized, and Cedar Creek is an intermittent stream within the project area, they are not likely to support a productive sport fishery. However, beyond the study area, they maintain permanent flow throughout the year. There were 33 and 461 angler-use days/year for Cedar (1977) and Mill Creek (1978) respectively. Species caught include channel and flathead catfish, bullhead, and largemouth bass (46). Cedar Lake supports seven species of gamefish including: largemouth bass, bluegill, channel catfish, crappie, bullhead, green sunfish, and sunfish. Olathe Lake maintains a more diverse fishery. It contains those fish found in Cedar Lake plus walleye, white bass, warmouth, and carp (45). Channel catfish is the only species stocked with any regularity in either lake (46).

License sales in Johnson County for 1978 are shown in Table B-12, in Appendix B. There were a total of 24,720 licenses sold, producing revenues of $166,485.00.

d. Agriculture. There were 85,594 acres of harvested cropland in Johnson County in 1969. The most important crops grown in the county include corn, wheat, sorghum, and soybeans. Livestock in Johnson County consist of cattle and hogs (See Table B-13, in Appendix B.) (55).

Approximately 95 percent of the acreage within the study area is classified as "prime agricultural land" by the USDA Soil Conservation Service (92). This is land with slopes and soil types able to provide the optimum conditions for crops and management systems without excessive erosion, and with a minimum expenditure of energy in management.

7. Wastewater Programs

a. Previous Planning. The idea of using only one or two treatment plants to serve an entire discrete creek basin has been recommended in several sewerage studies performed around and within the study area.

1) Report on Mill Creek Basin. In 1966, a study of the Mill Creek basin presented two alternative master plans for the collection and treatment of sewage. One plan involved using a single treatment plant at the Kansas River. The recommended plan involved two permanent treatment plants, one at the Kansas River and one near 95th street.

A more detailed study was prepared for the Little Mill Creek sub-basin. The plan proposed constructing an oxidation pond to serve the upper watershed, and later abandoning it in favor of a treatment plant near the junction of Little Mill Creek and Mill Creek when growth warranted (4).

2) Report on the Harold Street Plant Improvements. In 1971, a report was prepared for upgrading the Harold Street Wastewater Treatment Plant. The report recommended that Olathe negotiate an agreement with the County, whereby the City's sewage eventually would be discharged to an interceptor sewer constructed along Mill Creek. It also suggested that talks should begin with the County concerning the Cedar and Little Cedar Creek watersheds. Improvements to the existing plant were to be performed to the extent necessary to maintain service until new basin-wide facilities could be placed in service (93). All improvements recommended in the report were implemented, and are shown in Figure 15.

3) Report on Cedar Creek Basin. A report was prepared for the Cedar Creek basin in 1973. Two general schemes were presented; one including a proposed lake below the confluence of the Cedar and Little Cedar Creeks, and the other without the proposed lake. Each scheme included alternatives of a single plant for the entire basin, or two plants, one at the Kansas River, and one at the confluence of Cedar and Little Cedar Creeks. The plans using two treatment plants were recommended (5).

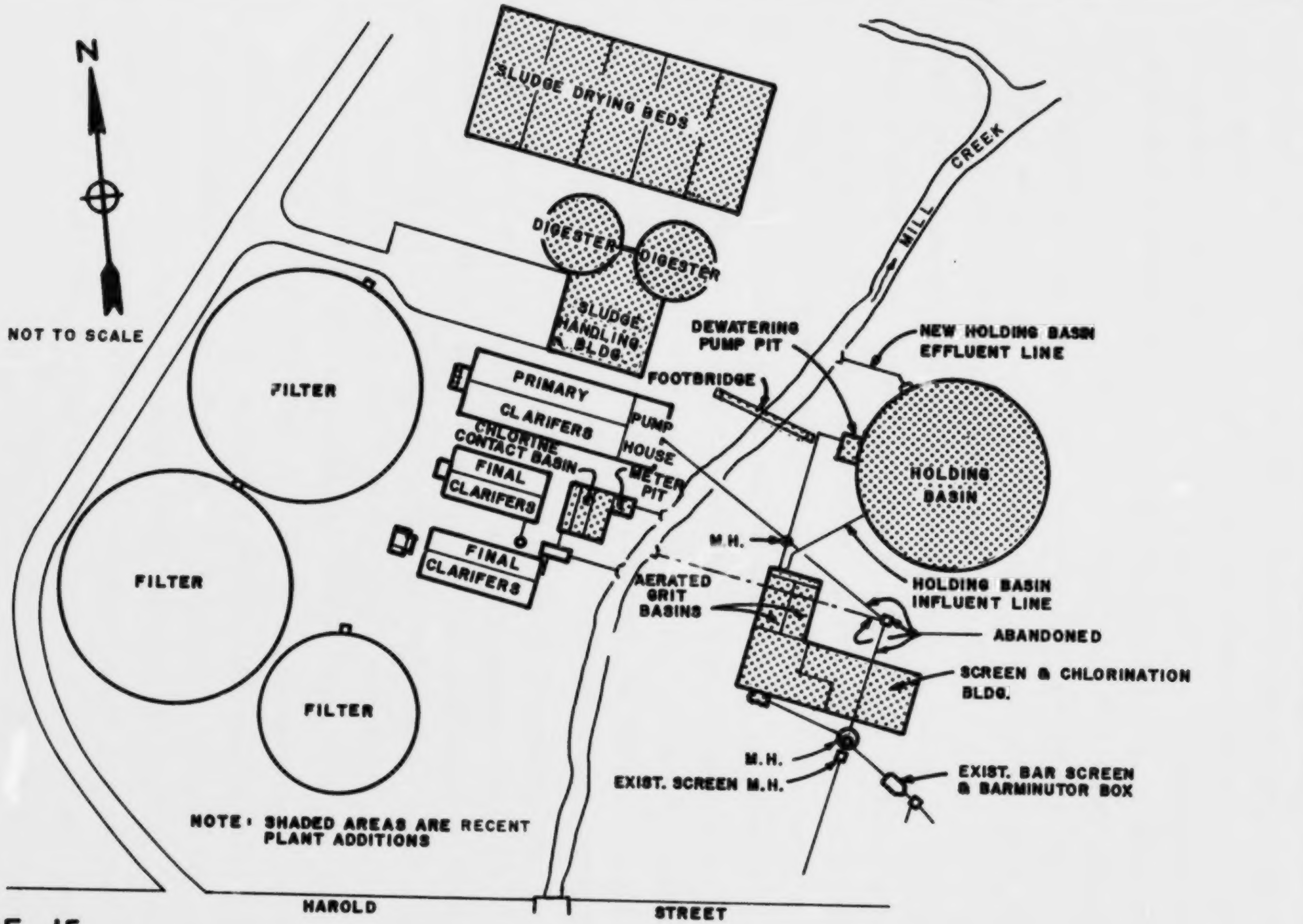

N
NOT TO SCALE
SLUDGE DRYING BEDS
DIGESTER
DIGESTER
SLUDGE HANDLING BLDG.
MILL CREEK
DEWATERING PUMP PIT
NEW HOLDING BASIN EFFLUENT LINE
FOOTBRIDGE
HOLDING BASIN
FILTER
PRIMARY CLARIFERS
PUMP HOUSE
CHLORINE CONTACT BASIN
METER PIT
FINAL CLARIFERS
FINAL CLARIFERS
M.H.
FILTER
AERATED GRIT BASINS
HOLDING BASIN INFLUENT LINE
ABANDONED
SCREEN & CHLORINATION BLDG.
FILTER
M.H.
EXIST. SCREEN M.H.
EXIST. BAR SCREEN & BARMINUTOR BOX
NOTE: SHADED AREAS ARE RECENT PLANT ADDITIONS
HAROLD
STREET

FIGURE 15
HAROLD STREET S T P SITE LAYOUT

SOURCE: REF. (93)

4) Point Source Water Quality Management Plan. The 303 plan for the Kansas River basin was approved in July, 1976. Prepared by the Division of Environment, State of Kansas, this plan forms the basis for distribution of federal grants to publicly owned sewage treatment works. It also supports the concept of separate treatment plants in the Cedar and Mill Creek basins (94).

5) 208 Water Quality Plan. The Water Quality Management 208 Final Plan was approved in December, 1978. The 208 plan deals with the development of regional wastewater management plans. Based on uncalibrated, worst-case modeling of dissolved oxygen levels, the 208 plan classifies Mill Creek as having "severe" water quality problems; Cedar Creek is listed as having "moderate" water quality problems. Because of institutional considerations, the 208 plan recommends initial continuation of existing designated wastewater management agencies in Johnson County, including Olathe and the Johnson County Unified Sewer District, and implicitly approves the basin-by-basin approach. It recommends eventual consolidation of all facilities in Johnson County under the Unified Sewer District.

b. Description of Existing Facilities

1) Collection Systems. This study area contains 77 miles of sewers, not including Leeview Estates or the recent developments of Persimmon Hills or Lakestone Estates. Approximately 90 percent of the sewers are vitrified clay pipe; the rest are either cast iron or reinforced concrete pipe. Sewer depths range from 3.5 feet to over 15 feet, with an average depth of about 6 feet. Excavated material is normally used for backfill. Some sewers are over 75 years old. The lengths and sizes of the sewers in the study area are summarized in Table D-1, in Appendix D. The total length of household service lines within the study area is estimated to be about 62 miles. These service lines are principally 6-inch-diameter vitrified clay pipe (9), and are in addition to the sewers shown on Table D-1.

The lateral sewers and known problem areas in the collection system are maintained by a regular program administered by the City of Olathe. Most sewer repairs are performed by City crews; however, some contracts for sewer repairs or replacement have been awarded.

All sewage collected in the Cedar and Little Cedar Creek basins, except that received by the Younts lift station and that from Leeview Estates, Persimmon Hills, and Lakestone Estates, either flows by gravity or is pumped to the K-7 lift station. The K-7 lift station in turn pumps to the Harold Street treatment plant. Sewage from the Younts lift station is pumped directly to the Harold Street plant.

An infiltration/inflow (I/I) survey performed as part of the facilities planning process estimated that 80 percent of the peak I/I is from foundation drains, basement drains, and household service connections on private property. The study indicated that it is not cost-effective to remove the peak I/I from the sewers in either major area tributary to the Harold Street plant (9). The KDHE did not concur with the conclusion of non-excessive I/I in the Mill Creek basin (95), so the City began a sewer system evaluation survey in that basin in the spring of 1979 (33).

2) Treatment Facilities. The majority of the wastewater in the study area is treated by the Harold Street Wastewater Treatment Plant. Other treatment facilities in the study area include the Leeview Estates Treatment Plant and the Persimmon Hills and Lakestone Estates stabilization ponds, all of which are maintained by the City of Olathe. Palmer View, Cedar Hills, and Wyckford Estates subdivisions, and a trailer park near Olathe Lake utilize septic tank systems (9, 10).

The Harold Street plant, on Mill Creek at the intersection of Harold and Chestnut Streets, was designed as a secondary treatment facility for an average daily flow of 1.5 MGD. The actual capability is 2.0 mgd, and the maximum hydraulic capacity is 3.3 mgd (93). The existing facility includes screening equipment, aerated grit basins, extraneous flow facilities, primary sedimentation basins, trickling filters, secondary sedimentation basins, chlorination facilities, anaerobic digesters, drying beds, and laboratory facilities. A summary of the effluent characteristics taken from the quarterly NPDES reports (Permit No. M-KS52-I001, KS-0045802) is given in Table D-2, in Appendix D.

The Harold Street plant serves about 2,000 acres of the Mill Creek basin by gravity flow. One 30-inch and two 24-inch gravity lines discharge into the plant. The remainder of the Mill Creek basin, most of the Little Cedar Creek basin, and some Cedar Creek areas are served by this treatment plant through a series of lift stations. The existing lift stations and their capacities are listed in Table 10. Figure 16 shows the present Harold Street plant service area, the 11 lift stations listed in Table 10, and the other existing treatment facilities.

Leeview Estates is served by a system of gravity sewers and a package sewage treatment plant with a design capacity of 30,000 gallons per day (9). The development is in the northwest part of Olathe, east of Kansas Highway 7 and north of Harold Street. The treatment plant utilizes extended aeration and sedimentation before discharging to a tributary of Little Cedar Creek. The effluent is not required to be disinfected, since it does not flow through a populated area. Also, the cost of repairing the broken chlorinator is considered too high for the benefits derived (96). A summary of the effluent characteristics taken from the quarterly NPDES reports (Permit No. M-KS52-004, KS-0045781) is given in Table D-3, in Appendix D.

Persimmon Hills is in the Little Cedar Creek basin, northeast of Olathe Lake. Its sewage is presently handled by a temporary, three-cell, non-discharging lagoon, which was constructed during the summer of 1978. A non-discharge NPDES permit application has been submitted for EPA approval. This is a state-approved temporary means of waste treatment, and will be allowed to operate only until permanent facilities are available. The lagoon is designed to serve 80 homes without discharging. It is also designed to adequately treat sewage from 80 to 150 homes while discharging to a branch of Little Cedar Creek, at which time a discharge permit will be needed. Only the first cell is presently in use.

TABLE 10
EXISTING LIFT STATIONS

Lift Station	Watershed	Capacity (gpm)	No. of Pumps
1. Provence	Cedar Creek	150 @ 50 ft.	2
2. Younts	Little Cedar Creek	100 @ 38 ft.	2
3. Dennis & Weaver	Little Cedar Creek	30 @ 20 ft.	1
4. Kansas Avenue	Little Cedar Creek	30 @ 15 ft.	1
5. Prairie Center	Little Cedar Creek	300 @ 46 ft.	2
6. K-7	Little Cedar Creek	1000 @ 70 ft.	2
7. Harold and Van Mar	Mill Creek	2600 @ 56 ft.	1
8. North Woodland & 126th Street	Mill Creek	100 @ 60.5 ft.	2
9. Ridgeview & 121st Street	Mill Creek	450 @ 112.5 ft.	2
10. Dennis & Mill Creek	Mill Creek	300 @ 18 ft.	2
11. Sunset & Dennis	Mill Creek	100 @ 19.5 ft.	2

Source: Ref. (9, 33).

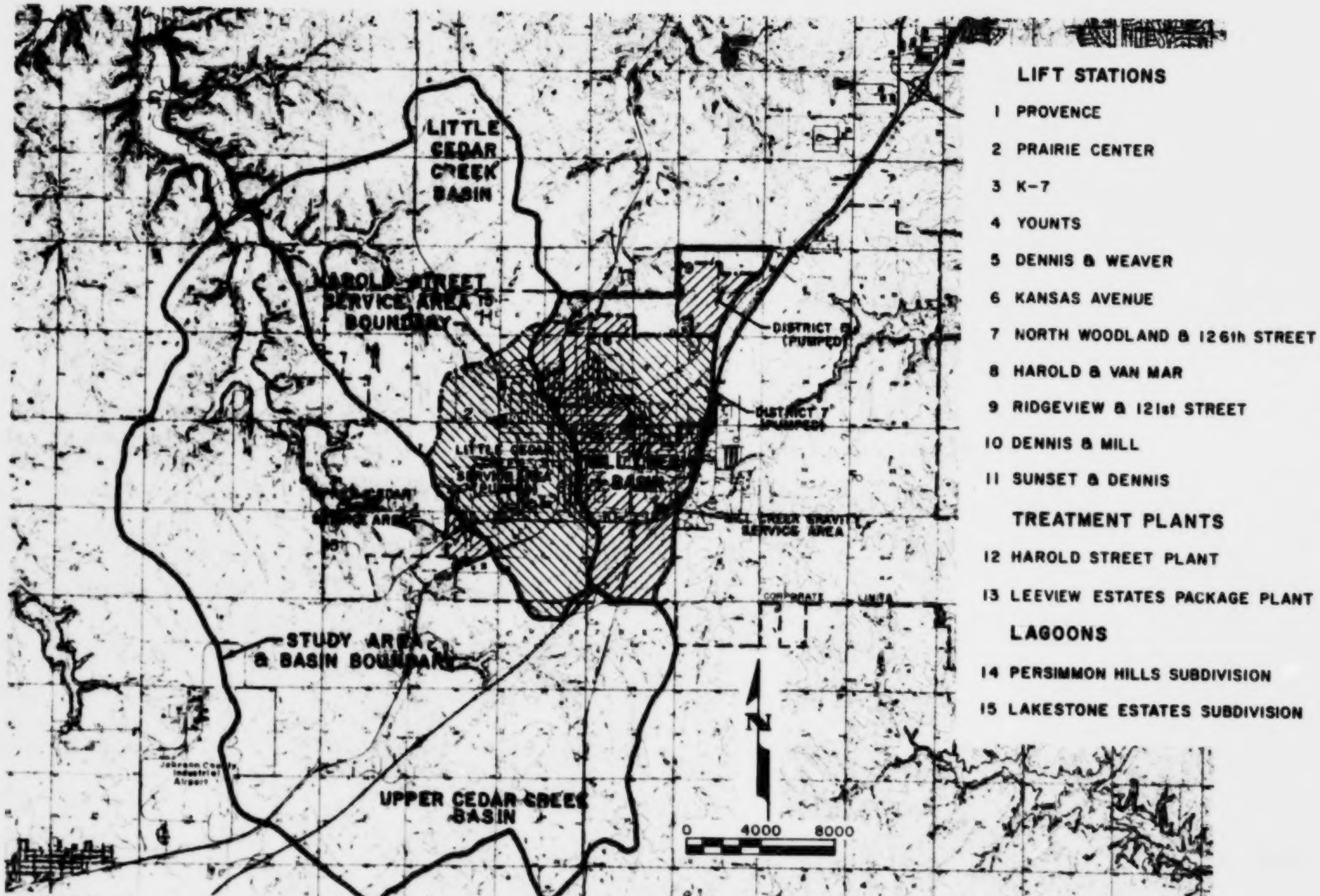

LITTLE CEDAR CREEK BASIN
HAROLD STREET SERVICE AREA BOUNDARY
DISTRICT 8 (PUMPED)
DISTRICT 7 (PUMPED)
LITTLE CEDAR SERVICE AREA (PUMPED)
CEDAR SERVICE AREA
BASIN
STREET GRAVITY SERVICE AREA
CORPORATE LIMITS
STUDY AREA & BASIN BOUNDARY
Johnson County Industrial Airport
UPPER CEDAR CREEK BASIN
N
0
4000
8000
LIFT STATIONS
1 PROVENCE
2 PRAIRIE CENTER
3 K-7
4 YOUNTS
5 DENNIS & WEAVER
6 KANSAS AVENUE
7 NORTH WOODLAND & 126th STREET
8 HAROLD & VAN MAR
9 RIDGEVIEW & 121st STREET
10 DENNIS & MILL
11 SUNSET & DENNIS
TREATMENT PLANTS
12 HAROLD STREET PLANT
13 LEEVIEW ESTATES PACKAGE PLANT
LAGOONS
14 PERSIMMON HILLS SUBDIVISION
15 LAKESTONE ESTATES SUBDIVISION

FIGURE 16
EXISTING FACILITIES &
HAROLD STREET PLANT SERVICE AREA

SOURCE: REF. (9)

Lakestone Estates, south of Olathe Lake, is served by a two-cell, non-discharging lagoon (Permit Number: M-KS52-N001). This is also a temporary means of waste treatment, approved only until permanent facilities are available. The first cell is designed to serve 23 lots and the second cell 16 lots. Excess wastewater has needed to be removed only once since its construction in 1976. This excess wastewater (quantity unknown) was pumped to Cedar Creek to maintain a water depth of three to five feet. There are presently 23 lots discharging to the lagoon (33).

3) Industrial Pretreatment. Delco-Remy pre-treats its plant wastes in facilities designed to remove lead by precipitation and to adjust the pH. A City ordinance (33) limits the discharge from these facilities to 500,000 gpd, with a maximum instantaneous discharge rate of 1,000 gpm. Suspended solids are limited to a maximum of 1,250 pounds per day, with the average for three consecutive operating days not to exceed 965 pounds per day. The daily average concentration of lead discharged cannot exceed 2.0 mg/l, while the weekly and monthly lead concentrations cannot exceed 1.5 and 1.0 mg/l, respectively. The pH of the Delco-Remy wastes must be between 6.0 and 9.5. These parameters are measured by Delco-Remy, and are reported to the City upon request. Measurements reported to the City to date are presented in Table D-4, in Appendix D.

4) Other Pertinent Treatment Facilities. There are three additional treatment facilities that discharge to Mill Creek: the Little Mill Creek North plant, the Mill Creek plant, and the Lenexa Municipal Wastewater plant. The effluent characteristics of these facilities are presented in Table D-5, in Appendix D.

The Mill Creek plant serves the Johnson County USD's Mill Creek Sub-district No. 2, which extends to the northeastern city limit of Olathe. Negotiations are under way for this 0.6 mgd complete-mix extended aeration plant to receive the sewage from Olathe's Sewer District 13A, which is presently pumped to the Harold Street plant.

Long-range planning also calls for eventual expansion of this plant to about 10 mgd, allowing for abandonment of the Harold Street plant, but no action is anticipated on this proposal before the year 2000 (97).

c. Existing Problems

1) Harold Street Wastewater Treatment Plant. Average daily flows to the Harold Street plant are near or at the plant's 3.3 mgd hydraulic capacity, exceeding its 2.0 mgd treatment capacity. An extraneous flow basin has been constructed to accept flows in excess of 3.3 mgd, with the intention of pumping this flow back into the plant when influent flows drop below the design capacity. However, the flow is not often below the design capacity; therefore, the stored extraneous flows usually cannot be pumped back into the treatment system. During periods of wet weather, flows often exceed the extraneous flow basin's capacity, and must be discharged to Mill Creek after receiving only sedimentation and chlorination. These flows are due to I/I in the sewer system. Discharges from the extraneous flow basin to Mill Creek occurred 16 times between November 3, 1977 and May 8, 1978 (33). The characteristics of those discharges are listed in Table D-6, in Appendix D. The data indicate that the BOD and TSS levels usually exceeded the 30 mg/l BOD and 30 mg/l TSS standards for discharge from the Harold Street plant. Fecal coliform counts were not taken.

The only space available to expand the plant without relocating homes or businesses is to the north, on the old City landfill site. Construction on the landfill could be expensive because of the foundation uncertainties involved and the awkward piping arrangements that would be required. Expansion of the Harold Street plant is not desired by local officials because of the recommendations of all previous plans that all facilities in Johnson County be consolidated under the Unified Sewer District, eventually abandoning the Harold Street plant.

2) Lift Stations. The Harold Street plant receives flow from 11 lift stations in the study area (see Table 10). Six of these stations receive flows in excess of their capacity, primarily during

periods of wet weather (see Table 11). The Dennis and Weaver and the Kansas Avenue at South Street lift stations experience surcharging during periods of equipment malfunctions and power failures. This excessive flow is pumped into the storm sewers until the pump station is serviceable again. The 15-inch interceptor to the K-7 lift station frequently cannot handle peak discharges from Delco-Remy. Flows in excess of its capacity are bypassed to Little Cedar Creek (98). The other three lift stations also bypass excessive flows to nearby streams. These bypasses violate water quality regulations, which require that all domestic wastes receive secondary treatment.

3) Septic Tanks. Palmer View, Cedar Hills, and Wyckford Estates subdivisions, and a trailer park near Olathe Lake, use septic tank systems (10). These systems have failed periodically, as evidenced by sewage surfacing in the Wyckford Estates subdivision. Sewage problems have occurred in Palmer View Estates to the extent that a moratorium was declared on building new homes on lots as originally platted (10). Area soils are generally unsuitable for septic tank systems due to slow percolation and shallow depth of rock (see Section 8, Part A, this chapter), and the 303 plan (94) has recommended elimination of septic tanks in most of Johnson County.

4) Uneconomical Operations. Persimmon Hills and Lakestone Estates utilize stabilization lagoons for sewage treatment. These lagoons are temporary facilities that are allowed to operate only until permanent facilities are available, and will then be abandoned. These facilities were constructed as a result of the combination of the moratorium on sewer extensions in the Cedar and Little Cedar basins and the pressure for residential development in the area. Capital costs for the two facilities totaled $105,700, and their combined annual operation and maintenance costs are estimated to be about $5,500 (99). City officials are concerned that a continuation of the present circumstances will lead to many such facilities in the study area, with resulting operational inefficiencies caused by the

TABLE 11
PROBLEM LIFT STATIONS

Lift Station	Date Installed	Date Modified	Overflow Discharge	When
Prairie Center	1955	1973	Little Cedar Creek	Wet weather, power failure
K-7	UNK*	1970	Little Cedar Creek	Wet weather, power failure
Younts	1956	1969	Little Cedar Creek	Flood or power failure
Provence	1963	N/A	Cedar Creek	Wet weather, power failure
Dennis & Weaver	1960	N/A	Out of Street Manholes to Little Cedar Creek	Equipment or power failure
Kansas Avenue	1956	N/A	Out of Street Manholes to Little Cedar Creek	Equipment or power failure

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* Unknown

Source: Ref. (33).

need to send operators from site to site. Since such facilities will certainly be replaced with a centralized treatment plant in the near future, their capital costs would be considered largely wasted.

The Younts, Provence Village, Prairie Center, and K-7 lift stations pump sewage from a total population of about 5,000 persons (33), and all sewage pumped by the Provence Village and Prairie Center stations is pumped again by the K-7 station. The estimated cost of operating and maintaining these four lift stations to transfer sewage from the Cedar Creek basin to the Harold Street plant in the Mill Creek basin is $16,600 per year (99), a cost that would be greatly reduced if gravity flow could be used instead.

8. Water Supply

The City of Olathe's water supply is from both ground and surface sources. Olathe operates eight wells in the Kansas River Valley alluvium, near Desoto. The wells are from 56-66 feet deep, and yield about 500-1,000 gpm each, with a total capacity of 6 mgd. The well water is treated by softening, chlorination, and removal of dissolved iron in a 4-mgd treatment plant near the well field. The average usage from the wells in 1978 was approximately 2.75 mgd (33).

Surface water is obtained from Olathe Lake, which has a storage capacity of 3,380 acre-feet (about 1.1 billion gallons). Cedar Lake, approximately 2 miles southeast of Olathe Lake, functions as an auxiliary water source. It has a storage capacity of 720 acre-feet (about 235 million gallons) (12). Surface water is treated at a 3.5 mgd plant in the center of town by means of chemical addition, settling, filtration, chlorination, and fluoridation. Average water usage from Olathe Lake in 1978 was approximately 1.46 mgd. There presently are no plans to expand this plant (33).

Olathe supplies water to Water Districts 1, 2, 3, 5, and 7. Districts 3, 5, and 7 are in the study area, and consumed 24,195,300, 57,043,660, and 37,736,800 gallons, respectively, in 1978. Districts 1 and 2 received 26,692,800 and 207,650 gallons respectively in 1978.

Two other water districts in the study area, 6 and 6A, receive water from the City of DeSoto (33).

9. Water Rights

There are no water rights (the legal right to withdraw a specified amount of water at a particular point along a stream) registered with the Kansas Division of Water Resources on Cedar Creek from the proposed treatment plant site to the Kansas River (100). There may be domestic users, whose water rights do not have to be registered. City officials have received no complaints regarding inter-basin transfers of wastewater from Cedar Creek to Mill Creek; neither have any downstream water users complained about degraded water quality in either basin (98).

10. Community Services and Facilities

The expansion of community services (police and fire protection, schools, hospitals, utilities) can sometimes lag behind rapid population growth, creating serious deficiencies in available service capacity. To avoid this, Olathe's policy of encouraging rapid residential growth has been accompanied by a commitment to expand community services. Until recently, that commitment has been evident mainly east of I-35, with a new fire station constructed and in operation, and new schools under construction. Now, Olathe is attempting to balance its growth by development to the west, and plans for expanding community services are being developed. A new elementary school has been built in Persimmon Hills. Land has been set aside for another, as well as for a new fire station, although no construction is expected until population warrants it. In 1981, the police district west of K-7 will be split in two, doubling the full-time police coverage. Details of the City's efforts to expand community services to the west are presented in Table 12 (101-110).

TABLE 12
COMMUNITY SERVICES AND FACILITIES

Service: Provider	Extent of Existing Service	Planned Improvements Affecting Project Area
Police Protection:		
Olathe Police Department	47 officers; Area west of K-7 is one district with 1 officer on duty 24 hours.	Area west of K-7 becomes 2 districts in 1981; 1 full-time officer in each.
Johnson County Sheriff	110 officers; station in Olathe; planning area is part of a district.	No specific plans.
Fire Protection:		
Olathe Fire Department	27 firemen; main station at Kansas and Santa Fe.	Land reserved for new station in study area, but no present plans to build.
Outlying Fire Districts	Mutual aid agreements between outlying districts and City.	No specific plans.
Education:		
Olathe Unified School District No. 233	12 elementary schools, 2 junior highs, senior high, vocational school, special school for handicapped, Head Start school. Most of planning area is in district.	New junior and senior high schools (1981, 1982, respectively) will relieve overcrowding; one of 2 new elementary schools (1980) is in study area. Land acquired for another elementary school, but no present plans to build.
Kansas School for the Deaf	Enrollment 286; all funding by State.	No specific plans.

TABLE 12 (Cont.)

Service: Provider	Extent of Existing Service	Planned Improvements Affecting Project Area
Health Care:		
Olathe Community Hospital	100 beds; general acute care services.	Olathe Community applied for 40-bed expansion; delayed by court action over moratorium on expansions because of excess capacity in KC.
Shawnee Mission Medical Center	300 beds; 15 miles north of Olathe.	
Humana Suburban Medical Center	200 beds; 7 miles north of Olathe.	
Mid-Continent Psychiatric Hospital	35 beds plus outpatient services.	
Utilities:		
Union Gas System	Serves entire planning area.	No specific plans.
Kansas Power and Light Company	Serves area north of Prairie Center and west of I-35.	
Kansas City Power and Light Company	Serves all other parts of Olathe.	

Sources: References (101-110)

11. Taxes and Budgeting

The assessed valuation in the City of Olathe has risen from $76,150,134 in 1977 to $85,683,511 in 1978, and is estimated to increase to $95,820,000 for 1979 (78). The current city tax rate is $3.2071 per $100 assessed valuation, yielding current city property tax receipts of approximately $2.748 million.

As of June 30, 1979, there were $7,189,432 worth of general obligation bonds, $4,105,000 in water and sewer bonds, and $1,623,000 worth of other short-term bonds outstanding. The general obligation bonds and the short-term bonds are paid through city taxes, while the water and sewer bonds are paid entirely through user charges.

In general, Olathe's financial status is good, as steady increases in the tax base have allowed the City to maintain a high level of services.

12. Other Projects and Programs

There are no other projects or programs known to be planned or under way that would have a significant bearing on the issues of this EIS.

CHAPTER III DEVELOPMENT OF ALTERNATIVES

A. INTRODUCTION

EPA must choose from three basic courses of action regarding further funding for the proposed Olathe sewerage project. It must fund the City's selected project, deny funding altogether, or fund a modified project. The third choice gives EPA considerable latitude, ranging from requiring minor changes in the project to requiring that a completely new approach be taken, if Federal funds are to be used. Such requirements are enforced by making them legally-binding conditions of accepting grant funding.

To provide the information necessary for making a sound choice among the three basic options, an EIS must analyze all the available alternatives. This includes both rigorously examining the alternative projects considered by the applicant and, if necessary, developing new alternatives to deal with possibilities that were not adequately addressed in the Facilities Plan.

This chapter contains descriptions of the alternative projects considered in the Facilities Plan, and of the rationale leading to the choice of the 201's Selected Project. The situation resulting from EPA denying funds for the project (the "no-action" alternative), and the development of two alternatives that were not adequately addressed in the Facilities Plan, are also described. The effects of the various alternatives will be compared in Chapter IV.

B. FACILITIES PLAN ALTERNATIVES AND SELECTED PROJECT

1. General Approach

The main existing pollution problems in the study area are the overloading of the Harold Street treatment plant, with consequent NPDES permit violations, and the wet weather bypassing and overflows at various lift stations in the Cedar and Little Cedar Creek basins. The Facilities Plan rejects the option of expanding the Harold Street plant as a possible solution to these problems primarily because all long-range planning for the Mill Creek basin calls for that plant eventually to be abandoned, and because of the belief that the plant's restricted site would cause excessive construction costs. Other reasons cited are that all regional planning calls for separate treatment facilities in each major watershed, and that continued pumping from the Cedar and Little Cedar basins would become increasingly uneconomical as the population growth projected for those areas occurs. However, no data are presented to support these contentions.

The Facilities Plan's approach is to restore and maintain the adequacy of the Harold Street plant by transferring flows that are presently being pumped to that plant to other treatment facilities. Wastewater from Sewer Districts 7 and 13a, in the northeast corner of the study area, will be transferred to the Johnson County Unified Sewer District's Mill Creek plant at some unspecified point in the future. Negotiations are presently underway to transfer District 13a, but no talks have been held concerning District 7. The major relief of the Harold Street plant will be provided by constructing a new treatment facility in the Cedar Creek basin to handle existing and future flows from that area. This approach will also allow the existing problem lift stations to be abandoned by collecting sewage from their service areas with gravity sewers.

2. Design Flows

a. Average Dry Weather Flows. The Facilities Plan sizes all treatment processes for the average daily dry weather flows. These flows are computed using 100 gallons per capita per day (gpcd) from the entire projected population of the areas being served and the population projections for 1990 and the year 2000 (see Table 5, Chapter II), plus the average daily contribution from the Delco-Remy plant specified in its agreement with the City. The 100 gpcd includes an unspecified allowance for some commercial and light industrial wastewater generated in the study area. By comparison, the 2.2 mgd average daily flow (not dry weather) at the Harold Street plant in

1976 and the estimated 1980 service area population of 22,900 yield an average contribution of 96 gpcd. The resulting design flows are given in Table 13, below.

TABLE 13
AVERAGE DRY WEATHER FLOW

Area	Average Flow (gpd) 1980	1990	2000
Little Cedar Creek	740,000	1,100,000	1,540,000
Upper Cedar Creek	260,000	460,000	720,000
Delco-Remy	300,000	300,000	300,000
TOTAL	1,300,000	1,860,000	2,560,000

b. Peak Dry Weather Flows. The Facilities Plan designs treatment works hydraulic capacities and pumping station capacities using peak dry weather flows that are 2.5 times the average daily dry weather flow, plus the peak Delco flow rate (set by permit) of 500,000 gallons per day. Table 14 summarizes these flows. Peak dry weather flows are also a factor in sizing extraneous flow holding basins.

TABLE 14
PEAK DRY WEATHER FLOW

Area	Estimated Flow (gpd) 1980	1990	2000
Little Cedar Creek	1,850,000	2,750,000	3,850,000
Upper Cedar Creek	650,000	1,150,000	1,800,000
Delco-Remy	500,000	500,000	500,000
TOTAL	3,000,000	4,400,000	6,150,000

c. Peak Wet Weather Flows. The Facilities Plan uses peak wet weather flow rates to size gravity sewers, and also as a factor in sizing extraneous flow holding basins. Two sets of interceptor alternatives, differing only in size, are developed using different definitions of peak wet weather flow. A third definition of peak wet weather flow is used to size extraneous flow holding basins.

The first set of interceptor alternatives, the "A" alternatives, is sized using a peak wet weather flow at "ultimate development" of 0.01 cfs per tributary acre. This figure is derived from previous studies in heavily-developed (10.5 persons/acre) parts of Johnson County, and represents measured flows that combined peak diurnal flows from major contributors with peak wet weather infiltration and inflow (I/I). By using this flow rate on an acreage basis, the Facilities Plan makes two key implied assumptions: 1) that the entire study area will achieve an "ultimate development" population density of 10.5 persons/acre within the useful life of the interceptors; and, 2) that the Olathe study area's new sewer system will be subject to I/I as severe as that experienced in the previous study areas. The total peak wet weather flow in each basin used for sizing the "A" alternatives is given in Table 15, below.

TABLE 15
PEAK WET WEATHER FLOWS FOR "A" ALTERNATIVES
(At "ultimate development")

Area	Estimated Flow
Little Cedar Creek	49,120,000 gpd (76 cfs)
Upper Cedar Creek	102,110,000 gpd (158 cfs)

The second set of interceptor alternatives, the "B" alternatives, is also sized using figures derived from the earlier studies mentioned above. The 10.5 persons/acre and the 0.01 cfs/acre values determined in those studies convert to approximately 650 gpcd. To partly comply with EPA design criteria requiring that peak flow rates not exceed 3 times the average daily dry weather flow rate, the "B" alternatives are sized for peak flows of 650 gpcd from presently-developed areas, and 300 gpcd from areas that are not developed.

The populations used, however, are again the "ultimate development" populations, calculated at 10.5 persons per total acre, rather than the design year populations. The result is that, in actuality, the "B" alternatives are sized using peak wet weather flows of 0.0046 cfs/acre in the Upper Cedar Creek watershed, and 0.0064 cfs/acre in the Little Cedar Creek basin; the latter value being derived from an assumption that one-third of the Little Cedar Creek basin is presently developed. The total peak wet weather flow rates used to size the interceptors in the "B" alternatives are given in Table 16, below.

TABLE 16
PEAK WET WEATHER FLOWS FOR "B" ALTERNATIVES
(At "ultimate development")

Area	Estimated Flow
Little Cedar Creek	31,670,000 gpd (49 cfs)
Upper Cedar Creek	46,850,000 gpd (72.5 cfs)

In comparison with the "A" alternatives, the peak flow rates used to size the "B" alternatives implicitly assume that an "ultimate development" population density of 5.25 persons/acre will be reached in the Upper Cedar Creek basin within the useful life of the interceptors; that the Little Cedar Creek basin will achieve a population density of about 6.47 persons/acre in the same period; and that the sewer systems to be built in those areas will be subject to I/I at rates similar to those of the areas studied earlier, but lower, in proportion to the lower population densities.

By contrast, the extraneous flow holding basins for each set of alternatives are sized using the design year population projections (rather than the "ultimate development" populations) and the daily per capita contribution rates applicable to the particular set of alternatives. Thus, the holding basins for the "A" alternatives are designed using the peak wet weather flows shown in Table 17, which are based on 650 gpcd times the design year populations, while the "B" alternatives holding basins are based on flows of 650 gpcd from the existing population plus 300 gpcd from future population.

TABLE 17
PEAK WET WEATHER FLOW FOR "A" ALTERNATIVE HOLDING BASINS

Area	Estimated Flow (gpd) 1980	1990	2000
Little Cedar Creek	4,810,000	7,150,000	10,010,000
Upper Cedar Creek	1,690,000	2,990,000	4,680,000
Delco-Remy	500,000	500,000	500,000
TOTAL	7,000,000	10,640,000	15,190,000

To achieve the "ultimate development" population density of 10.5 persons per total acre used as the basis for the sizing of the interceptors would require a total population of 245,700 persons in the Little and Upper Cedar Creek basins. This is more than twice the 108,800 people predicted for those two basins in Table 5 (in Chapter II), which was developed by assuming a continuation of existing population densities in Olathe. In addition to using questionably high flow rates to size the interceptors, the Facilities Plan also sizes interceptors 18 inches in diameter and smaller to flow half full at peak flow, and those greater than 18 inches in diameter to flow two-thirds full at peak flow. EPA guidelines require sizing for pipes larger than 21" in diameter to be based on carrying the design flow when 3/4 full.

3. Treatment Alternatives

a. Loading Criteria. Five treatment systems are evaluated in the Facilities Plan. The per capita loading criteria used in the development of these alternatives are: 1) Average Flow - 100 gpd; 2) Maximum Flow - 250 gpd; 3) BOD_5 - 0.20 lbs/day; and 4) Suspended Solids - 0.25 lbs/day.

b. Treatment Plant Capacities. All the Facilities Plan treatment alternatives will be constructed in two stages. Stage I, to be constructed in 1980, has a design capacity of 2 mgd, peak hydraulic capacity of 5 mgd, and extraneous flow storage facilities for 5,700,000 gallons. These capacities are based on the 1990 flow projections. The second stage of construction, about 1990, will provide an additional 1 mgd design capacity, 2.5 mgd peak hydraulic capacity, and 2 million gallons of extraneous flow storage capacity, and is intended to be adequate through the year 2000.

c. Alternative Systems. The five alternative treatment systems evaluated by the Facilities Plan are complete mix activated sludge, high-rate redwood media trickling filter, field erected extended aeration package treatment plant, oxidation ditch, and land treatment. The first four alternatives have similar components, except that the oxidation ditch has no primary sedimentation or anaerobic digestion components, and the package plant does not use anaerobic digestion. The principal components of the treatment works for the first four alternatives, with the above-noted exceptions, are as follows:

Liquid Treatment	Solids Handling	Other
Grit Removal	Gravity Thickening	Laboratory & Maintenance Building
Influent Pumping	Anaerobic Digestion	Extraneous Flow Storage Basins
Primary Sedimentation	Mechanical Dewatering	
Final Clarification	Landfill/Land Spreading	
Effluent Pumping		
Chlorination		

Stage II expansion of all the treatment alternatives is similar, with the exception of the package plant. In Stage II, the package plant's internal equipment would be removed from the concrete basins, and the plant would be converted to a conventional complete mix activated sludge system.

The fifth alternative, land treatment, is quite different from the first four. KDHE regulations require at least primary treatment of wastewater before its application to land for direct treatment purposes. Based upon a review of the clay-loam soil near the proposed plant site at the confluence of Little and Upper Cedar Creeks, the loading rate estimates for this type of soil, and the requirement for at least 90 days' storage capacity, over 600 acres of land would be required for the Stage I development of a land treatment system. Stage II expansion would require an additional 300 acres. Because of these land requirements, poor soil acceptability, and development pressures for land, the direct land application treatment system was eliminated from consideration.

d. Treatment Requirements. All proposed treatment systems will provide secondary treatment of wastes to meet the applicable NPDES discharge permit requirements of 30 mg/l BOD_5, 30 mg/l SS, and 200 fecal coliform colonies per 100 ml. In all the plans, the effluent would be discharged into Cedar Creek below its confluence with Little Cedar Creek. Disinfection by chlorination will be provided if required by the State.

e. Treatment System Selection.

1) Operability Evaluation. Operation is an important factor in the selection of a treatment system. A brief description of advantages and disadvantages are outlined below for each treatment system.

System	Advantages	Disadvantages
Complete Mix	1) low air requirements 2) withstands most shock loadings 3) ease of expansion	1) high capital costs 2) use of mechanical aerators can cause operational difficulties in cold weather 3) high degree of operator expertise needed
Trickling Filter	1) low operating costs 2) ease of operation	1) high capital costs 2) reduced plant efficiency in winter 3) difficult to expand
CMAS Package Plant	1) smaller land requirements 2) ease of operation	Same as Complete Mix
Oxidation Ditch	1) low operating costs 2) ease of operation 3) excellent BOD reduction	1) high capital costs 2) large land requirements 3) difficult to expand

Since the treatment systems all require about the same numbers and level of expertise of operating personnel, and are all capable of meeting discharge requirements, plant operability is not the dominant parameter in the selection of a treatment system.

2) Cost Evaluation. Since operability is not the determining factor in the selection of the treatment alternative, a cost analysis determines the selection. Table 18 summarizes the present worth of each treatment system. The following conditions are applied to all alternatives in the present worth analysis:

a) Planning Period - 20 years.
b) Interest Rate - 6-7/8 percent.
c) Costs as of March, 1979.
d) No allowances for inflation.
e) Land is assumed to have a permanent life.
f) Structures are assumed to have 50-year life.
g) Process equipment is assumed to have 20-year life.
h) Auxiliary equipment is assumed to have 15-year life.

TABLE 18

SUMMARY OF PRESENT WORTH OF
ALTERNATIVE TREATMENT SYSTEMS

Alternative	Capital Costs	O&M Costs	Total
Complete Mix Activated Sludge	$6,800,000	$2,500,000	$9,300,000
High-Rate Redwood Media Trickling Filter	6,600,000	2,100,000	8,700,000
Package Plant/ CMAS Plant	6,600,000	1,900,000	8,500,000
Oxidation Ditch	5,500,000	1,500,000	7,000,000

Based on this analysis, the Facilities Plan selects an oxidation ditch system to treat the sewage from the Little and Upper Cedar Creek service areas. The plant will have an initial capacity of 2 mgd, with provision for expansion to 3 mgd.

4. Interceptor Alternatives

a. General. Nine interceptor alternatives are investigated by the Facilities Plan. Each plan provides interceptor sewers and/or force mains to convey wastewater to the central treatment facility. All plans have extraneous flow basins where gravity interceptors terminate at either the treatment plant or a lift station to accept flows in excess of the dry weather peak flow. All alternatives also include constructing connecting sewers to the lift stations (Prairie Center, Younts, and Provence Village) that are to be abandoned. These connecting sewers are sized to receive flows from the projected "ultimate development" of their tributary areas. The K-7 lift station will be temporarily retained to pump only the Delco-Remy flow to the Harold Street plant, since this flow essentially contains no nutrients, but does contain some solids and some dissolved lead. This combination makes it undesirable to treat the Delco-Remy flow at the new plant until domestic flows have increased and treatability studies have been performed to determine when the Delco wastewater will not have a detrimental effect on plant biological processes. A 24-inch sewer will be constructed to provide relief for an existing 15-inch sewer that extends from the K-7 Lift Station upstream to an existing 24-inch sewer at a point southeast of Santa Fe and Monroe Streets. When it is determined that all Delco flows can be safely diverted to the new treatment plant, the K-7 Lift Station will be abandoned. The Leeview Estates package treatment plant will also be abandoned by connecting its influent line to the proposed Little Cedar Creek interceptor.

b. Alternative Interceptor Alignments. As discussed in Section 2, above, the Facilities Plan develops two sets of four interceptor alignments each, using a different definition of peak flow for each set. The only differences in the two sets are the pipe and extraneous flow basin sizes. The ninth alternative, the project selected by the Facilities Plan, is not directly comparable to either set of alignments because it uses different sizing criteria for the various interceptors. All of the alternatives propose phased construction to keep the sewerage improvements abreast of the growth anticipated in the area. The nine Facilities Plan interceptor alternatives are briefly described below.

1) Plan I-A. The major facilities considered under Plan I-A are shown on Figure 17, and include:

STAGE 1 (1980)

° A 2 mgd treatment plant at the confluence of Cedar and Little Cedar Creeks.

° A gravity interceptor sewer, designed for 0.01 cfs/acre (the flow generated by "ultimate development"), paralleling Little Cedar Creek from the K-7 lift station to the treatment plant.

STAGE 2 (1985)

° A gravity interceptor sewer, designed for 0.01 cfs/acre, paralleling Cedar Creek from the south end of Olathe Lake to the treatment plant.

STAGE 3 (1990)

° A 1 mgd addition to the treatment plant.

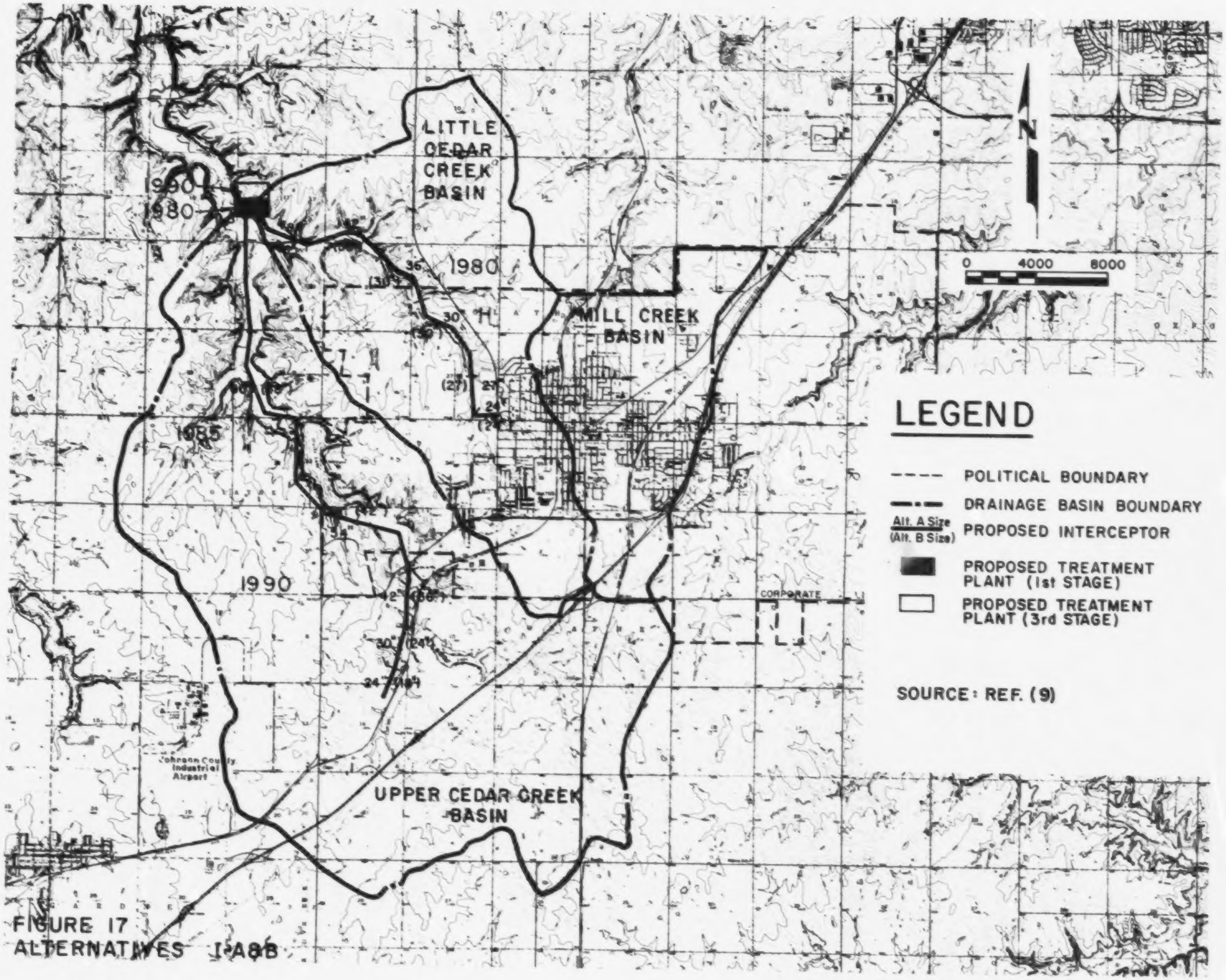
° A gravity interceptor sewer extension, designed for 0.01 cfs/acre, paralleling Cedar Creek from the south end of Olathe Lake to the headwaters (a point near the center of Section 16, T14S, R2E).

2) Plan II-A. The major facilities considered under this plan are shown on Figure 18, and are identical to those of Plan I-A, above, except that the interceptor sewers are sized for 0.005 cfs/acre (half the flow generated by "ultimate development"), with the intention (not included in the project costs) of constructing parallel interceptors of equal size at some time beyond the design period.

3) Plan III-A. The major facilities considered under this plan are shown on Figure 19, and include:

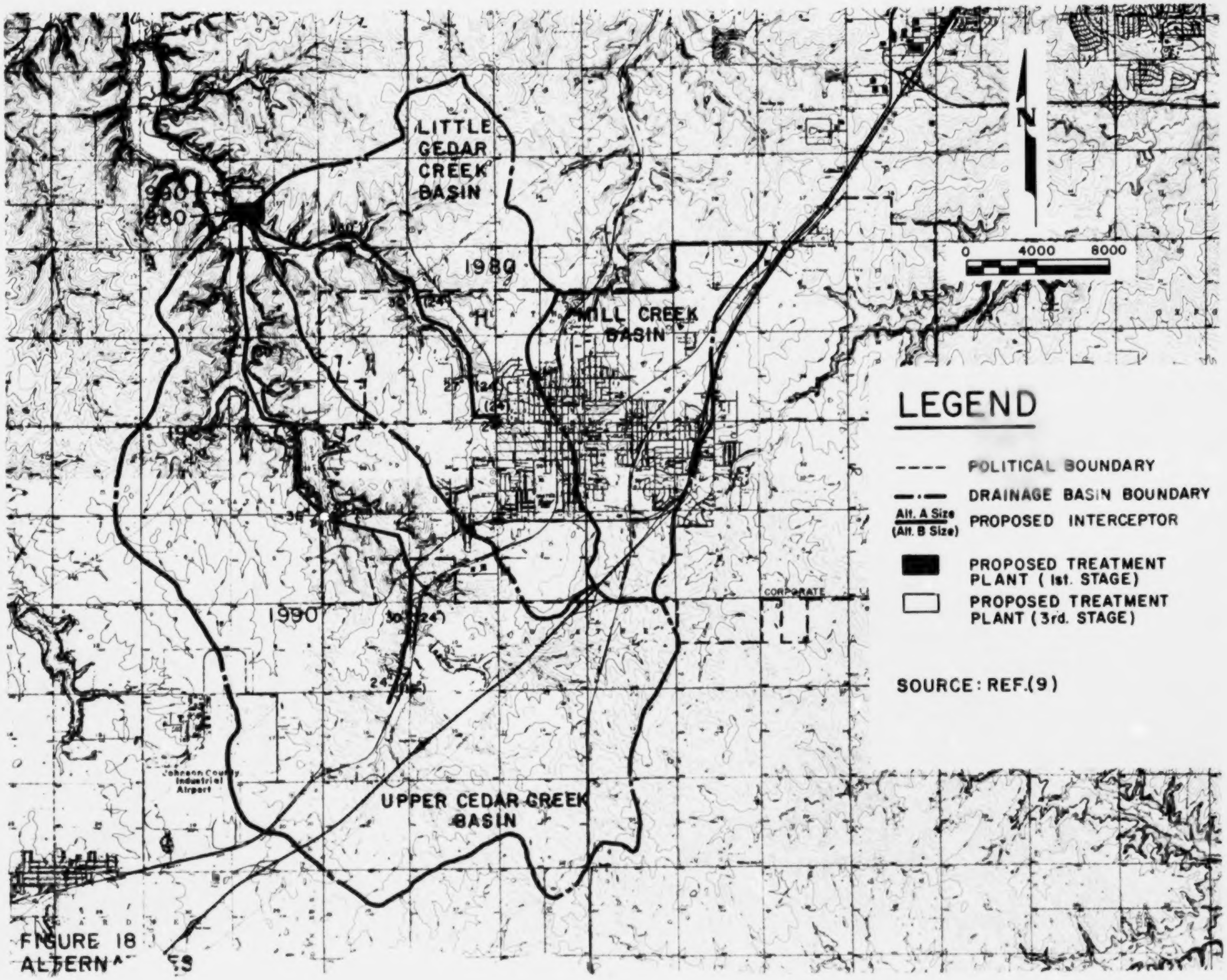
STAGE 1 (1980)

° A 2 mgd treatment plant at the confluence of Cedar and Little Cedar Creeks.


N
0
4000
8000
LITTLE CEDAR CREEK BASIN
MILL CREEK BASIN
UPPER CEDAR CREEK BASIN
1990
1980
1980
1985
1990
36
(30)
30
(27)
27
24
(24)
42
(36)
30
(24)
24
(18)
CORPORATE
Johnson County Industrial Airport
LEGEND
POLITICAL BOUNDARY
DRAINAGE BASIN BOUNDARY
Alt. A Size
(Alt. B Size)
PROPOSED INTERCEPTOR
PROPOSED TREATMENT PLANT (1st STAGE)
PROPOSED TREATMENT PLANT (3rd STAGE)

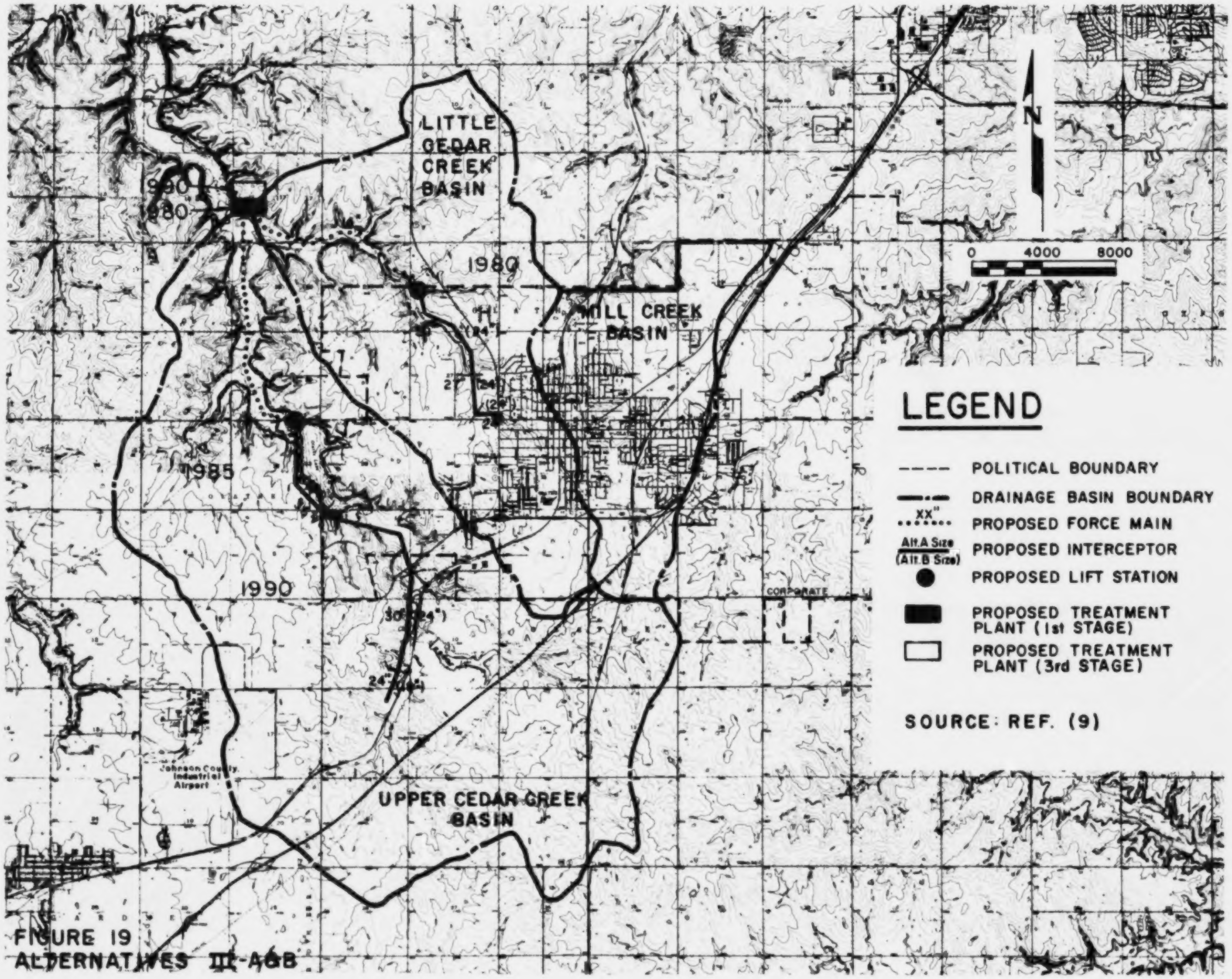
SOURCE: REF. (9)

FIGURE 17
ALTERNATIVES I-A&B


LITTLE CEDAR CREEK BASIN
MILL CREEK BASIN
UPPER CEDAR CREEK BASIN
1980
1990
Johnson County Industrial Airport
CORPORATE
0
4000
8000
N
LEGEND
POLITICAL BOUNDARY
DRAINAGE BASIN BOUNDARY
Alt. A Size
(Alt. B Size)
PROPOSED INTERCEPTOR
PROPOSED TREATMENT PLANT (1st. STAGE)
PROPOSED TREATMENT PLANT (3rd. STAGE)

SOURCE: REF.(9)

FIGURE 18
ALTERNA[illegible]ES


LITTLE CEDAR CREEK BASIN
MILL CREEK BASIN
UPPER CEDAR CREEK BASIN
1980
1985
1990
Johnson County Industrial Airport
CORPORATE
0
4000
8000
N
LEGEND
POLITICAL BOUNDARY
DRAINAGE BASIN BOUNDARY
XX"
PROPOSED FORCE MAIN
Alt.A Size
(Alt.B Size)
PROPOSED INTERCEPTOR
PROPOSED LIFT STATION
PROPOSED TREATMENT PLANT (1st STAGE)
PROPOSED TREATMENT PLANT (3rd STAGE)

SOURCE: REF. (9)

FIGURE 19
ALTERNATIVES III-A&B

° An interceptor sewer, designed for 0.005 cfs/acre, paralleling Little Cedar Creek from the K-7 lift station to a new lift station at the north city limits.

° A lift station on Little Cedar Creek at the north city limits, discharging to a 14-inch-diameter force main along Little Cedar Creek from the lift station to the treatment plant.

STAGE 2 (1985)

° An interceptor sewer, designed for 0.005 cfs/acre, around the west side of Olathe Lake.

° A lift station at the north end of Olathe Lake, discharging to a 12-inch-diameter force main paralleling Cedar Creek from the lift station to the treatment plant.

STAGE 3 (1990)

° A 1-mgd addition to the treatment plant.

° Pumping capacity increases at both new lift stations.

° An interceptor sewer extension, designed for 0.005 cfs/acre, paralleling Cedar Creek from the south end of Olathe Lake to the headwaters.

4) Plan IV-A. The major facilities considered under this plan are shown on Figure 20 and include:

STAGE 1 (1980)

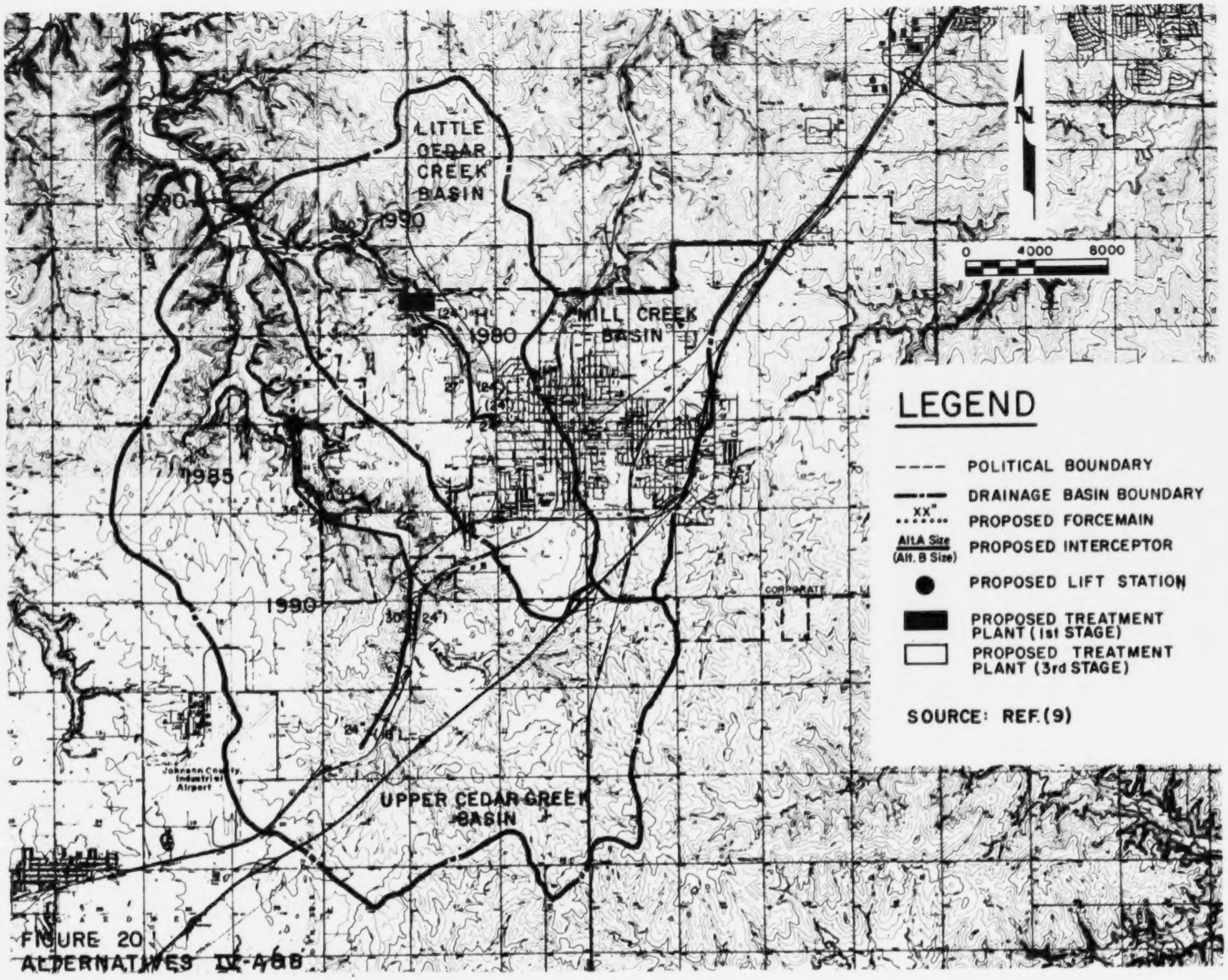
° A 2-mgd interim treatment plant on Little Cedar Creek at the north city limits.

° An interceptor sewer, designed for 0.005 cfs/acre, paralleling Little Cedar Creek from the K-7 lift station to the interim treatment plant.

STAGE 2 (1985)

° A lift station at the north end of Olathe Lake, discharging to a 12-inch-diameter force main extending from the lift station to the interim treatment plant.

° An interceptor sewer, designed for 0.005 cfs/acre, around the west side of Olathe Lake.


LITTLE CEDAR CREEK BASIN
MILL CREEK BASIN
UPPER CEDAR CREEK BASIN
1990
1980
1985
1990
1990
(24")
24"
30"
(24")
24"
CORPORATE
Johnson County Industrial Airport
N
0
4000
8000
LEGEND
POLITICAL BOUNDARY
DRAINAGE BASIN BOUNDARY
XX"
PROPOSED FORCEMAIN
Alt.A Size
(Alt. B Size)
PROPOSED INTERCEPTOR
PROPOSED LIFT STATION
PROPOSED TREATMENT PLANT (1st STAGE)
PROPOSED TREATMENT PLANT (3rd STAGE)

SOURCE: REF. (9)

FIGURE 20
ALTERNATIVES IV-A&B

STAGE 3 (1990)

° A 3-mgd permanent treatment plant at the confluence of Cedar and Little Cedar Creeks. The interim plant constructed in Stage I will be abandoned, and its salvagable equipment relocated to, and incorporated in, the permanent plant. Continuous treatment will be maintained by keeping the interim plant in service until the permanent plant is complete.

° An interceptor sewer, designed for 0.005 cfs/acre, paralleling Little Cedar Creek from the interim treatment plant to the permanent plant.

° An interceptor sewer extension, designed for 0.005 cfs/acre, paralleling Cedar Creek from the south end of Olathe Lake to the headwaters.

° Pumping capacity increases at the lift station at the north end of Olathe Lake.

5) Plans I - IV-B. The major facilities considered under Plans I - IV-B are identical to those of Plans I - IV-A, except that the interceptor sizes are smaller because of the lower definition of peak wet weather flow used (see Section 2c, above). The interceptor sizes for these alternatives are shown in parentheses on Figures 17-20.

6) Facilities Plan's Selected Project. The major facilities included in the 201's Selected Project are shown on Figure 21, and are briefly described below:

STAGE 1 (1980)

° A 2-mgd treatment plant at the confluence of Cedar and Little Cedar Creeks.

° An interceptor sewer, designed for 0.01 cfs/acre, paralleling Little Cedar Creek from the K-7 lift station to the treatment plant.

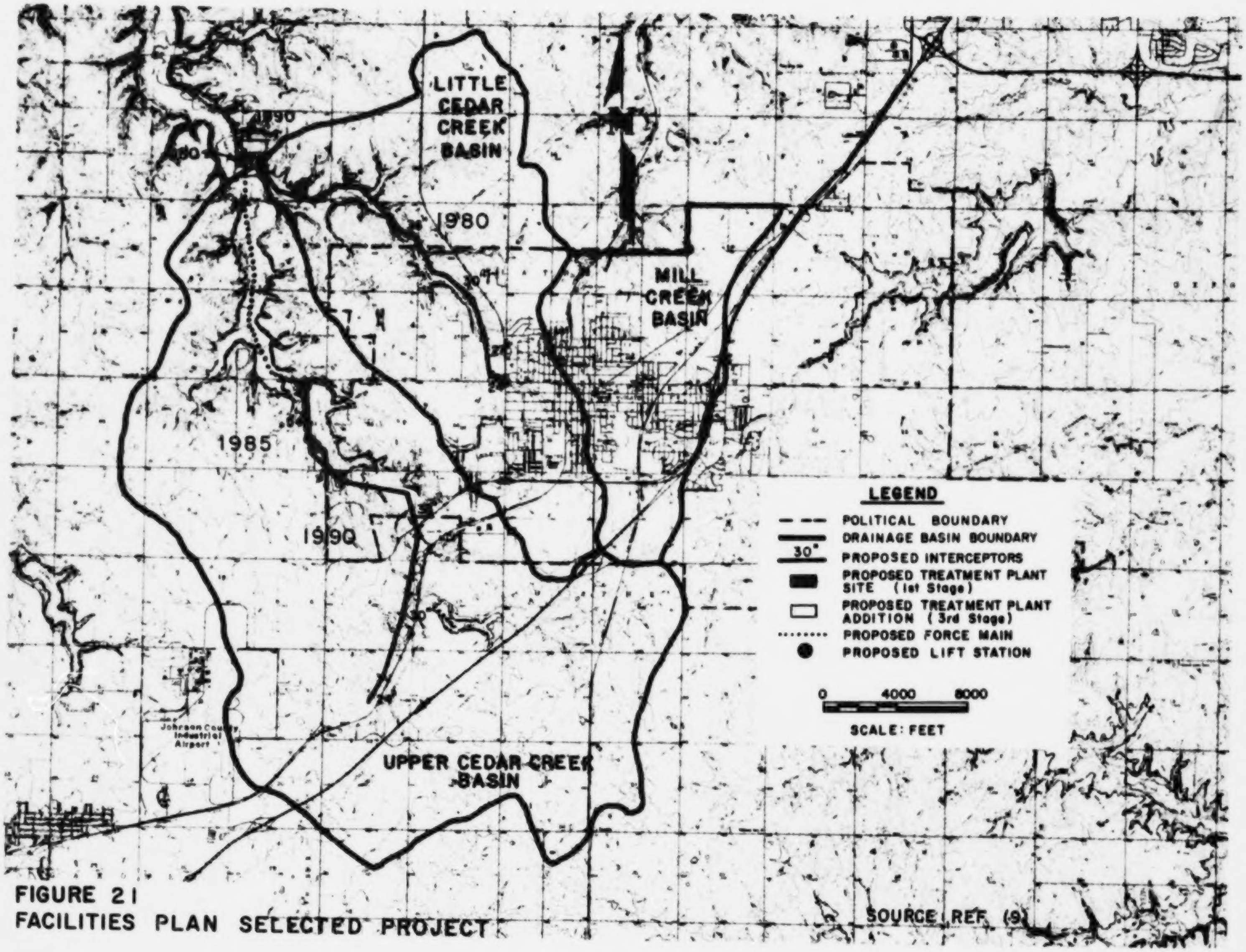

LITTLE CEDAR CREEK BASIN
MILL CREEK BASIN
UPPER CEDAR CREEK BASIN
1980
1985
1990
Johnson County Industrial Airport
LEGEND
POLITICAL BOUNDARY
DRAINAGE BASIN BOUNDARY
30"
PROPOSED INTERCEPTORS
PROPOSED TREATMENT PLANT SITE (1st Stage)
PROPOSED TREATMENT PLANT ADDITION (3rd Stage)
PROPOSED FORCE MAIN
PROPOSED LIFT STATION
0
4000
8000
SCALE: FEET

FIGURE 21
FACILITIES PLAN SELECTED PROJECT

SOURCE: REF. (9)

STAGE 2 (1985)

° A lift station at the north end of Olathe Lake, discharging to a 12-inch-diameter force main that parallels Cedar Creek from the lift station to the treatment plant.

° An interceptor sewer, designed for 0.01 cfs/acre, around the west side of Olathe Lake.

STAGE 3 (1990)

° A 1-mgd addition to the treatment plant.

° An interceptor sewer extension, designed for 0.005 cfs/acre, paralleling Cedar Creek from the south end of Olathe Lake to the headwaters.

° Pumping capacity increases at the lift station at the north end of Olathe Lake.

C. DEVELOPMENT OF THE NO-ACTION ALTERNATIVE

EPA could deny further grant funding for the Facilities Plan's selected project, or any modification of it, thus bringing about the alternative of no Federal action with respect to the project. In that event, Olathe would still be subject to State and Federal regulations, and would have to correct the existing pollution problems, but at the City's own expense. Several options available to the City in the event of no Federal action are described below.

1. Do Nothing

Olathe could elect to do nothing about either the overloading at the Harold Street plant or the overflows and bypasses at the lift stations in the Upper and Little Cedar Creek basins. Selection of this option is not considered likely, however, because it would result in unlawful violations of the Harold Street plant's NPDES permit, thus subjecting the City to enforcement action carrying a minimum penalty of $2,500 per day of violation.

2. Construct the Selected Project

The City could build the Facilities Plan's selected project without EPA funding. Selection of this option is also considered unlikely, because of the heavy drain it would place on the City's financial resources.

3. Minimum Work Plus Limited Growth

Olathe could construct only the minimum improvements needed to avoid violating the Harold Street plant's NPDES permit. Construction under this option would include extraneous flow basins and/or pumping capacity increases at the four problem lift stations; interceptors to divert the flows from Sewer Districts 7 and 13a to Johnson County USD's Mill Creek Sub-district No. 2 treatment plant, as are already planned; and a sewer system rehabilitation program in the Mill Creek and Little Cedar Creek basins to remove I/I, which would be done in any event, if found necessary.

This rather limited construction program would solve the study area's existing pollution problems and keep the Harold Street plant adequate throughout the planning period. However, it would not facilitate the projected population growth in the Cedar and Little Cedar Creek basins. To prevent that growth from causing additional problems in the future, the City and the County would need to adopt and strictly enforce stringent land use controls and sanitary codes, and the State would need to reinstate its moratorium on new sewer connections in the Cedar and Little Cedar Creek basins. In effect, these restrictions would amount to adopting a no-growth, or severely-limited-growth policy for the Cedar and Little Cedar Creek basins.

The construction work involved in this option might be considered grant-eligible by EPA, were Olathe to submit a new grant application and Facilities Plan detailing such a project. However, it is not considered likely that Olathe would select this option because of the intense pressure for development in the Cedar and Little Cedar Creek basins, the highly growth-oriented political climate of the

City, and the City's desire to balance the growth east of I-35 with development west of K-7.

4. Minimum Work Plus Numerous Small Treatment Facilities

The construction financed by the City under this option would be identical to that described above, and would similarly solve the existing pollution problems and keep the Harold Street plant adequate throughout the planning period. No new developments would be allowed to connect to the sewer systems tributary to the four problem lift stations, again similar to the option above. However, rather than actively discouraging the projected population influx to the Cedar and Little Cedar Creek basins, the City, County, and State would attempt to prevent future pollution problems by encouraging the use of alternative treatment systems. Where soils are suitable, on-site systems (septic tanks) would be permitted. Developers would be allowed to construct small package plants, total retention lagoons, or other suitable treatment systems to serve their subdivisions, and then turn them over to the appropriate body for operation and maintenance. This process would continue until development densities and operation and maintenance costs economically justified replacing the small plants with a centralized system similar to the 201's Selected Project.

This option is deemed the most likely to be chosen by the City, should EPA deny further grant funding for the 201's Selected Project. It would require a minimum initial capital investment by the City; could be implemented in a relatively short time; would probably be elibible for Federal grant funding, if the City chooses to submit a new Facilities Plan; and would allow continued growth in the study area.

D. EIS ALTERNATIVES

The Facilities Plan does not discuss alternative wastewater management plans, other than the relatively minor variations in interceptor routings and sizes described in part B of this chapter. Since the primary existing pollution problem used to establish the need for a project is the overloading of the Harold Street treatment plant, and since the City intends to keep that plant in operation throughout the design period, the Notice of Intent identified the need to develop alternatives that propose more direct solutions to the present problems as one of the major issues to be addressed by this EIS. To resolve this issue, two such alternatives were developed for comparison with those presented in the Facilities Plan. This section describes these new alternatives.

1. Harold Street Plant Expansion

a. General. The most obvious course of action directly addressing the overloading problem at the Harold Street plant is to expand the plant, and build such other facilities as are necessary to convey all of the study area's wastewater to it. The Facilities Plan summarily dismisses this alternative, giving as reasons the excessive construction costs anticipated to be caused by building on a restricted site that is also an abandoned landfill, the fact that all long-range planning calls for the plant to be abandoned, and the anticipated high cost of replacing aging plant equipment. None of these reasons is entirely valid, however. The cost of expansion cannot be assumed to be higher than that of other alternatives without making a detailed cost estimate. The long-range plans to abandon the plant have little bearing, since the plant is to be kept in operation throughout the design period. For the same reason, any plant equipment that would need to be replaced during an expansion program would also need to be replaced under the Facilities Plan's proposals.

b. Basis of Design. The facilities in the Cedar and Little Cedar Creek basins are sized using the same criteria as the 201's Selected Project (see Tables 13-17, in part B of this chapter). Facilities in the Mill Creek basin are sized using an average dry weather flow of 100 gpcd, a peak dry weather flow of 250 gpcd, and a peak wet weather flow of 650 gpcd. However, the peak wet weather flow is computed using the projected design year population, rather than the "ultimate development" population. The resulting wastewater flow rates for the Mill Creek basin are given in Table 19, below.

TABLE 19
MILL CREEK BASIN FLOW RATES (gpd)

	1980	1990	2000
Average Daily Dry Weather Flow	1,290,000	1,620,000	2,040,000
Peak Daily Dry Weather Flow	3,225,000	4,050,000	5,100,000
Peak Daily Wet Weather Flow	8,385,000	10,530,000	13,260,000

A trickling filter process identical to that already used at the Harold Street plant is arbitrarily chosen for the plant expansion to minimize operator retraining, provide interchangeability of process units and repair parts, and generally facilitate operation of the expanded plant. Extraneous flow basins are included at the treatment plant and the lift stations for flow equalization, and are sized by the same method used in the Facilities Plan. As in the Facilities Plan, the Younts, Prairie Center, and Provence Village lift stations and the Leeview Estates package plant will be abandoned by connecting to the proposed interceptors with short runs of gravity sewer. The K-7 lift station will be abandoned immediately, rather than kept in temporary, partial service, as in the Facilities Plan. The lift stations in Sewer Districts 13a and 7 would continue pumping to the Harold Street plant throughout the design period.

c. Description of Components. The major facilities considered under the Harold Street plant expansion alternative include:

STAGE 1 (1980)

° A 1.5 mgd expansion of the Harold Street plant.

° An interceptor sewer, sized for 0.01 cfs/acre, paralleling Little Cedar Creek from the K-7 lift station to the confluence of Cedar and Little Cedar Creeks.

° A lift station at the confluence of Cedar and Little Cedar Creeks, discharging to an 18-inch-diameter force main extending along 119th Street, Parker Road, and Harold Street to the Harold Street treatment plant.

STAGE 2 (1985)

° An interceptor sewer, sized for 0.01 cfs/acre, around the west side of Olathe Lake.

° A lift station at the north end of Olathe Lake, discharging to a 12-inch-diameter force main extending along Prairie Center Road, K-7 Highway, Parker Road, and Harold Street to the Harold Street treatment plant.

STAGE 3 (1990)

° Another 1.5 mgd expansion of the Harold Street plant.

° An interceptor sewer extension, sized for 0.005 cfs/acre, paralleling Cedar Creek from the south end of Olathe Lake to the headwaters.

° Pumping capacity increases at both new lift stations.

2. Abandon the Harold Street Plant

Olathe is reluctant to expand the Harold Street plant because all long-range planning calls for it to be abandoned in favor of a larger plant downstream. Therefore, perhaps the best course of action directly addressing the overloading problem is to abandon it now, and expand the Johnson County Unified Sewer District's Mill Creek plant, at 99th Street and Mill Creek, to accept the additional load. This approach is made even more attractive by the Facilities Plan's statement that much of the Harold Street plant's equipment will need to be replaced during the design period.

The construction proposed in the Cedar and Little Cedar Creek basins under this alternative is identical to that proposed for the Harold Street plant expansion alternative, above. A gravity interceptor sewer about 4 miles long will be constructed along Mill Creek from the Harold Street plant site to the Mill Creek plant site. Branches from the interceptor will collect sewage from the lift stations in Olathe Sewer Districts 7 and 13a, allowing those lift stations to be abandoned. The upstream end of the interceptor is sized for the peak daily wet weather flow from the Mill Creek basin (see Table 19) plus the peak daily dry weather flows pumped from the Cedar and Little Cedar Creek basins (see Table 14), a total design flow of 19.41 mgd (30 cfs). At the available slope (0.005 ft/ft), flowing 3/4 full, this flow requires a 30-inch diameter pipe. Although the interceptor's size will undoubtedly be increased downstream, Olathe's share of the cost would be limited to that of a 30-inch pipe.

To accommodate Olathe's wastewater, the present 0.6 mgd complete-mix extended aeration Mill Creek plant will be expanded in two stages. The expansion program includes extraneous flow basins sized for the difference between the peak dry weather and peak wet weather flows from the Mill Creek basin. Olathe's share of the initial plant expansion is a 3.5 mgd increase in design treatment capacity (average daily dry weather flow) and a 6.5 million gallon extraneous flow basin. In 1990, Olathe will require an additional 1.5 mgd treatment capacity and a 2.0 million gallon extraneous flow basin.

TABLE 20
SUMMARY DESCRIPTION OF ALTERNATIVES

I. FACILITIES PLAN ALTERNATIVES AND SELECTED PROJECT

A. Treatment Plant

1. Treatment Capacity

Based on average daily dry weather flow of 100 gpcd times the total study area design year projected population.

1st Stage (1980) - 2 mgd, total
2nd Stage (1990) - 3 mgd, total

2. Hydraulic Capacity

Based on peak daily dry weather flow of 250 gpcd times the total study area design year projected population

1st Stage (1980) - 5 mgd, total
2nd Stage (1990) - 7.5 mgd, total

3. Selected Process

Oxidation ditch with grit removal, final clarification, chlorination, gravity sludge thickening, mechanical sludge dewatering, and landfill/land spreading for sludge disposal.

4. Location

All Facilities Plan Alternatives except IV-A and IV-B - both stages at confluence of Cedar and Little Cedar Creeks.

Alternatives IV-A and IV-B - 1st Stage at north city limits, on Little Cedar Creek.

B. Transportation/Storage Facilities

1. Alternative I-A

a. Interceptors sized for 0.01 cfs/acre peak daily wet weather flow (650 gpcd times projected "ultimate development" population) along Cedar and Little Cedar Creeks.

b. Extraneous flow holding basins at treatment plant for 24-hour retention of 400 gpcd times design year population of study area (650 gpcd peak daily wet weather flow minus 250 gpcd peak daily dry weather flow).

2. Alternative II-A

Same as I-A except that interceptors and extraneous flow holding basins sized using 0.005 cfs/acre (1/2 of peak daily wet weather flow) with intention of paralleling after year 2000.

TABLE 20 (Cont.)

3. Alternative III-A
   a. Interceptors sized for 0.005 cfs/acre along Cedar Creek to pump station at north end of Olathe Lake, and along Little Cedar Creek to pump station at north city limits.
   b. Pump stations, and force mains along both creeks to treatment plant at confluence, sized for peak daily dry weather flow of 250 gpcd times design year population of service areas.
   c. Extraneous flow holding basins at pump stations sized for design year population of service area times 75 gpcd (half of 650 gpcd peak daily wet weather flow minus 250 gpcd peak daily dry weather flow).

4. Alternative IV-A
   a. Interceptors, extraneous flow holding basins, and pump station at north end of Olathe Lake same as in 3, above.
   b. Force main sized for 250 gpcd times design year population from north end of Olathe Lake to interim plant on Little Cedar Creek at north city limits.
   c. About 1990, extend Little Cedar Creek interceptor to relocated treatment plant at confluence. Interceptor sized for 0.005 cfs/acre; extraneous flow holding basins at reloated plant sized for 75 gpcd times design year population of Little Cedar Creek basin only.

5. "B" Alternatives
   These alternatives are identical to the corresponding "A" alternatives except that, in each case, the interceptors and extraneous flow holding basins have been re-sized using 0.0046 cfs/acre as the definition of peak daily wet weather flow for the Upper Cedar Creek basin at "ultimate development, rather than 0.01 cfs/acre, and similarly use 0.0064 cfs/acre for the peak daily wet weather flow in the Little Cedar Creek basin at "ultimate development." As in the "A" alternatives, Alternate I-B is based on carrying the entire flow, alternatives II-B through IV-B are sized for half the flow of I-B, intending to parallel the sewers beyond the project design year.

TABLE 20 (Cont.)

6. Facilities Plan's Selected Project
    a. Interceptors sized for 0.01 cfs/acre along the entire Little Cedar Creek Valley, and around the west side of Olathe Lake.
    b. Pump station at the north end of Olathe Lake, and force main paralleling Cedar Creek to treatment plant at confluence, sized for 250 gpcd times the design year population of service area.
    c. Interceptor along Cedar Creek from south end of Olathe Lake south, sized for 0.005 cfs/acre.
    d. Extraneous flow holding basin at treatment plant sized for 24-hour retention of 400 gpcd times design year population of Little Cedar Creek basin.
    e. Extraneous flow holding basin at pumping station sized for 24-hour retention of 400 gpcd times design year population along west side of Olathe Lake, plus 75 gpcd times design year population south of Olathe Lake.

II. NO-ACTION ALTERNATIVE
    A. Design Parameters Not Developed. (too vague)

    B. Work Involved
        1. Extraneous flow holding basins and/or pumping capacity increases at Younts, Provence Village, Prairie Center, and K-7 lift stations (Prairie Center basin under construction already, as a temporary measure)

        2. Diversion of flow from sewer districts 13a and 7 to Johnson County USD's Mill Creek plant.

        3. Sewer system rehabilitation as needed in Mill and Little Cedar basins.

        4. Replacement of Harold Street plant equipment, as needed.

        5. Development of more stringent procedures for handling inspection of on-site systems; and of O&M program to handle numerous small plants.

III. EIS ALTERNATIVES
    A. Expand Harold Street Plant
        1. Treatment Process
            a. Trickling filter, with components identical to existing.

TABLE 20 (Cont.)

  - b. Two 1.5-mgd expansions (1980 and 1990), based on 100 gpcd times total projected study area design year population.
  - c. Replace existing equipment at Harold Street as needed.

2. Transportation and Storage System
  - a. Little Cedar Creek and Upper Cedar Creek interceptors, pump station at north end of Olathe Lake, and extraneous flow holding basins identical to Facilities Plan's Selected Project.
  - b. Force mains sized for 250 gpcd times design year populations from confluence of Cedar and Little Cedar Creeks and from north end of Olathe Lake to Harold Street plant.

B. Abandon Harold Street Plant

1. Treatment Process

   Expand USD's existing complete-mix extended aeration Mill Creek plant by 3.5 mgd in 1980 and another 1.5 mgd in 1990, based on 100 gpcd times total projected study area design year population.

2. Transportation and Storage System
  - a. Little Cedar and Cedar Creek basins same as A.2, above.
  - b. Interceptor paralleling Mill Creek from Harold Street plant to USD's Mill Creek plant sized for 650 gpcd times projected design year population in Mill Creek basin plus 250 gpcd times projected design year population of Cedar and Little Cedar Creek basins.
  - c. Extraneous flow holding basins at USD plant designed for 24-hour retention of 400 gpcd times projected design year population of Mill Creek basin.

CHAPTER IV EVALUATION OF ALTERNATIVES

A. INTRODUCTION

The course of action chosen by EPA must be both environmentally sound and an economical solution to the existing pollution problems in the study area. In this chapter, the alternatives developed in Chapter III are compared, and their effects evaluated in relation to the major issues of this EIS, to ensure that the alternative selected meets those critera.

B. COMPARABILITY OF ALTERNATIVES

Ideally, all alternative projects intended to serve a particular study area would be directly comparable, serving identical areas and populations, and collecting and treating identical flows. A cursory examination of the alternatives in this instance might give the impression that this project is such a case, since the treatment plant capacities and contributing populations are stated as being the same for all options. However, a closer look reveals significant differences in the various alternatives. These differences, and their effects on the evaluation process, are discussed in this section.

1. Design Flows

As discussed in Chapter III, the eight Facilities Plan alternatives, the 201's Selected Project, and the two alternatives developed during preparation of this EIS are all designed to treat a wastewater flow based on 100 gpcd, using the projected population of the entire study area in the design year. However, the interceptor systems and their appurtenant extraneous flow holding basins are designed using a total of six different peak flow conditions.

The interceptors in Facilities Plan Alternative I-A are sized to accomodate 0.01 cfs/acre from the entire Upper and Little Cedar Creek basins. Alternatives II-A through IV-A are sized to handle half of that flow, intending to construct parallel interceptors of equal size at some time beyond the design year. Alternative I-B is sized for 0.0064 cfs/acre in the Little Cedar Creek basin, and 0.0046 cfs/acre in the Upper Cedar Creek basin. Alternatives II-B through IV-B are sized for half the flow of Alternative I-B, again postulating a need for parallel sewers beyond the design period. The 201's Selected Project is sized for 0.01 cfs/acre in the Little Cedar Creek basin and around the west side of the Olathe Lake, and for 0.005 cfs/acre in the Upper Cedar Creek basin south of Olathe Lake. The alternative developed for expanding the Harold Street plant uses the same design criteria as the 201's Selected Project. The alternative developed to allow the Harold Street plant to be abandoned uses the same design criteria as the 201's Selected Project for the Upper and Little Cedar Creek basins, and also uses a peak wet weather flow of 650 gpcd from the Mill Creek basin, but uses the design year population, rather than the "ultimate development" population, to size the Mill Creek interceptor.

EPA guidelines allow a maximum interceptor size for grant funding eligibility based on a peak wet weather flow of 350 gpcd and the anticipated population at the end of a 50-year design life. All of the interceptor alternatives have capacities considerably beyond those computed in accordance with the guidelines, and all are more than capable of carrying the wastewater generated by the design year population. The important aspect here, however, is that the ability to compare the costs and other effects of the alternatives is severely restricted by the wide range of their flow-carrying capabilities, and the resulting differences in pipe and extraneous flow basin sizes.

2. Service Areas

There are also considerable differences in the areas and populations served by the various alternatives. Even though the treatment facilities of all alternatives are based on the total design year population of the study area, only Alternatives I-A, I-B, II-A, and II-B will actually serve the entire project area without constructing additional major facilities. All the other alternatives incorporate a pump station at the north end of Olathe Lake, effectively precluding service to all of the Upper Cedar Creek basin north of Prairie Center Road. The excluded area accounts for about 6,100 of the 15,800 acres in the Upper Cedar Creek basin, and about 450 of the basin's projected design year population of 7,200 persons.

In addition to the area described above, Alternatives III-A and III-B also exclude nearly all of the Little Cedar Creek basin north of 123rd Street, and another watershed tributary to Little Cedar Creek that lies west of the landfill. This latter watershed includes most of the Persimmon Hills Subdivision. These additional unserved areas contain about 3,300 of the Little Cedar Creek basin's 7,600 acres, and about 1,200 of that basin's projected design year population of 15,400 persons. Alternatives IV-A and IV-B also exclude these areas, but only until 1990, when the treatment plant will be moved to the confluence of Cedar and Little Cedar Creeks and the Little Cedar Creek interceptor will be extended to the plant. After that work is complete, alternatives IV-A and IV-B will exclude only the northern part of the Upper Cedar Creek basin.

The 201's Selected Project and the two alternatives developed during preparation of the EIS exclude only the northern part of the Upper Cedar Creek basin. The interceptor to the Johnson County USD Mill Creek plant at 99th Street in the alternative developed to allow the Harold Street plant to be abandoned will undoubtedly be sized to serve the area between Olathe and the Mill Creek plant. However, since Olathe's share of the cost will be limited to that attributable to the capacity needed to serve the project area, the larger total service area only affects the comparability of that alternative when considering any accelerated development that might be caused in the interceptor corridor.

The areal differences in service areas were considered in the interceptor sizing calculations, and do not directly affect cost comparisons among the alternatives (except that equals are not being compared). They do, however, affect discussions of political implementability and the ability of an alternative to induce growth.

The population reductions caused by the service area differences were not taken into account when computing those design flows based on population. This resulted in the treatment plant, pumping stations, and extraneous flow holding basins being somewhat larger than necessary in all alternatives except I-A, I-B, II-A, and II-B. Because of the relatively small number of persons projected to reside in the northern part of the Upper Cedar Creek basin, and the standard practice of rounding numbers in the preliminary design stage of a project, the oversizing resulting from excluding that area is not considered significant. However, the oversizing in Alternatives III-A and III-B, which also exclude much of the Little Cedar Creek basin, causes difficulties in making comparisons with those alternatives. Alternatives IV-A and IV-B are similarly affected, but to a lesser degree, because they do not provide service to the excluded parts of the Little Cedar Creek basin until after 1990. The costs of these alternatives could be corrected to reflect the smaller design flows involved, but there would still be no equitable way to compare the corrected costs because of the different populations served.

3. Cost Analysis

a. Facilities Plan Alternatives and Selected Project.

Table 21 gives the estimated capital costs of the 201's Selected Project, as presented in the Supplement to the Facilities Plan. These costs include all land and construction costs, contingencies, engineering and legal fees, and project administration costs.

Table 22 shows these capital costs reduced to their 1980 present worth (in terms of 1979 dollars), after allowing for the salvage value of any remaining useful life at the end of the design period. Table 22 also includes the present worth of the operating and maintenance costs of the project. The conditions applied in computing the present worth are the same as those used for the treatment works present worth summary in Chapter III, Part B, Section 3e.

TABLE 21
ESTIMATED PROJECT COSTS
FACILITIES PLAN SELECTED PROJECT

Item	Estimated Cost (1979$)
Stage I (1980)	
A. Transportation System	
Little Cedar Creek Interceptor	$ 2,500,000
Younts Connection	40,000
Prairie Center Connection	30,000
Leeview Estates Connection	240,000
B. Treatment Works	
2 mgd Oxidation Ditch Treatment Plant Complete With Extraneous Flow and Solids Handling Facilities	5,300,000
Total Stage I	$ 8,110,000
Stage II (1985)	
A. Transportation System	
Upper Cedar Creek Interceptor	$ 3,700,000
Upper Cedar Creek Pumping Station and Extraneous Flow Facilities	250,000
Upper Cedar Creek Force Main	680,000
Total Stage II	$ 4,630,000
Stage III (1990)	
A. Transportation System	
Expansion of Upper Cedar Creek Pumping Station and Extraneous Flow Facilities	$ 90,000
Extension of Upper Cedar Creek Interceptor	600,000
B. Treatment Works	
Expansion of Treatment Works to 3 mgd	1,400,000
Total Stage III	$ 2,090,000
Total Project Costs	$ 14,830,000

TABLE 22
PRESENT WORTH
FACILITIES PLAN SELECTED PROJECT

Item	Present Worth Capital Costs	Present Worth O&M Costs
A. Treatment Works		
Oxidation Ditch Treatment Plant, Solids Handling Facilities, and Extraneous Flow Basins	$ 5,500,000	$ 1,500,000
B. Transportation System		
Little Cedar Creek Interceptor	2,250,000	90,000
Connecting Interceptors	270,000	25,000
Upper Cedar Creek Interceptor	2,300,000	60,000
Upper Cedar Creek Pumping Station and Extraneous Flow Basins	200,000	65,000
Upper Cedar Creek Force Main	390,000	30,000
Total	$ 10,910,000	$ 1,770,000

Total Present Worth = $10,910,000 + $1,770,000 = $12,680,000

Similar capital and O&M cost estimates and reductions to 1980 present worth (in 1979 dollars) are given in the Supplement to the Facilities Plan for the other eight Facilities Plan Alternatives. Table 23 lists the present worth of the Facilities Plan Alternatives for comparison with that of the Selected Project. This comparison shows Alternatives III-B and II-B to be the least expensive, while only Alternative I-A costs more than the 201's Selected Project.

TABLE 23
PRESENT WORTH OF FACILITIES PLAN ALTERNATIVES

Plan	Capital Cost	O&M	Total Present Worth
I-A	$12,600,000	$1,710,000	$14,310,000
II-A	10,000,000	1,700,000	11,700,000
III-A	9,400,000	1,870,000	11,270,000
IV-A	10,800,000	1,740,000	12,540,000
I-B	10,800,000	1,710,000	12,510,000
II-B	8,800,000	1,700,000	10,500,000
III-B	8,300,000	1,860,000	10,160,000
IV-B	10,200,000	1,740,000	11,940,000
Selected Project	10,910,000	1,770,000	12,680,000

b. EIS Alternatives. Capital and O&M cost estimates were also made for the two alternatives developed during preparation of the EIS. The present worth of these alternatives, computed according to the same conditions used in the Supplement to the Facilities Plan, are shown in Table 24, below. Both of these alternatives are considerably more expensive than any of the Facilities Plan alternatives.

TABLE 24

PRESENT WORTH OF EIS ALTERNATIVES

Alternative	Capital Cost	O&M	Total Present Worth
Expand Harold Street Plant	$14,801,000	$2,787,000	$17,588,000
Abandon Harold Street Plant	$20,394,000	$4,420,000	$24,814,000

c. No-Action Alternative. No cost estimates were made for the No-Action Alternative because of the difficulty in estimating how many small treatment facilities would be needed, what size each should be, when they would need to be constructed, and how they would be staffed. It is considered probable that the total present worth of the No-Action Alternative would be comparable to that of the 201's Selected Project.

Under the No-Action Alternative, it is believed that more total land would be required for plant sites, the total construction costs for treatment plants would be higher, and the labor portion of the operating and maintenance costs would be higher because of the travel time between plants and the duplication of functions (servicing several small blowers instead of a few large ones) than under any of the Facilities Plan alternatives. However, it is also believed that these costs would be offset by eliminating the need for the large interceptors, the lift stations and their associated power costs, and the force mains of the Facilities Plan alternatives. These items account for almost half of the total present worth of the various alternatives. There would also be a time/interest-rate advantage accruing to the No-Action Alternative because the plants built would be phased to follow the need for additional capacity much more closely than the proposed two-stage plant construction of the Facilities Plan alternatives.

d. Cost Comparability. The difficulties in comparing the costs of the alternatives discussed in Sections 1 and 2, above, are compounded by the fact that only the alternative developed for abandoning the Harold Street plant includes all the costs of a complete solution to the problems given as reasons for the proposed project. All other alternatives are predicated on the Harold Street plant remaining in service throughout the design period, yet none of them include costs for the "extensive replacement" of its existing process equipment that the Supplement to the Facilities Plan states is necessary. In addition, the eight Facilities Plan alternatives and the 201's

Selected Project are further predicated on transferring the sewage presently contributed to the Harold Street plant from Sewer District 13a, and probably that from Sewer District 7, to Johnson County USD's Mill Creek plant during the design period. This work is necessary to keep the Harold Street plant's loading within its design range, because only 5-7,000 population equivalents will be removed by the new plant, but the population growth in the Mill Creek basin will be about 10,000 during the design period. However, no costs for this work are included in any of the alternatives. To correct this situation, and make the alternatives' costs more nearly comparable, cost estimates were made for the missing elements.

Since the Supplement to the Facilities Plan fails to state exactly what equipment needs to be replaced at the Harold Street plant, or when, an accurate cost estimate cannot be made. Therefore, a worst-case situation is postulated in which all existing process equipment at the Harold Street plant is replaced. Using Figure 15 as a guide, all equipment in the older (unshaded) parts of the plant is considered as needing replacement during Stage 1 (1980). Equipment installed during the 1972-73 upgrading of the plant (shaded areas) is considered as needing replacement in Stage 3 (1990). O&M costs for the existing plant are also included, even though they do not constitute an added cost over the existing situation, because they are costs that would not be incurred by the plant abandonment alternative, and thus need to be included for full comparability.

The total 1980 present worth (in 1979 dollars) of this work, using the same conditions for present worth calculations that were used for the other alternatives, and allowing for salvage value, is estimated to be $1,304,000. The present worth of operating and maintenance costs for the existing plant during the design period is estimated to be $1,614,000, giving a total present worth of $2,918,000 that must be added to the costs of all the other alternatives to make them comparable to the alternative of abandoning the plant.

Similarly, there is not enough information available to accurately estimate the costs of transferring the flows from Sewer Districts 7 and 13a to the Mill Creek plant. Therefore, it is assumed that the flow from Sewer District 13a will be transferred in 1980, and that Sewer District 7 will be transferred in 1990. To allow these transfers, it is assumed that Olathe will construct (or pay the equivalent cost of constructing) a 24-inch diameter interceptor along Mill Creek from about 121st Street to the Mill Creek plant, along with a 12-inch diameter branch from the interceptor to the Ridgeview lift station, in 1980. In 1990, it is assumed that Olathe will construct an 18-inch diameter branch from the interceptor to the Harold and Van Mar lift station, a 2.5 mgd expansion of the Mill Creek plant, and a 3 million gallon extraneous flow basin at the plant.

The total 1980 present worth of this work (in 1979 dollars) is estimated to be $3,021,000. The present worth of the operating and maintenance expenses during the design period is estimated to be $835,000, giving a total present worth of $3,856,000 that must also be added to the costs of all the Facilities Plan alternatives to make them comparable to the two alternatives developed during preparation of the EIS.

Table 25, below, shows the present worth of each of the eleven alternatives, adjusted for the missing costs discussed above.

TABLE 25
ADJUSTED PRESENT WORTH OF ALL ALTERNATIVES

Alternative	Capital Cost less Salvage Value	O&M	Total Present Worth
Abandon Harold Street Plant	$20,394,000	$4,420,000	$24,814,000
Expand Harold Street Plant	16,105,000	4,401,000	20,506,000
201's Selected Project	15,235,000	4,219,000	19,454,000
I-A	16,925,000	4,159,000	21,084,000
II-A	14,325,000	4,149,000	18,474,000
III-A	13,725,000	4,319,000	18,044,000
IV-A	15,125,000	4,189,000	19,314,000
I-B	15,125,000	4,159,000	19,284,000
II-B	13,125,000	4,149,000	17,274,000
III-B	12,625,000	4,309,000	16,934,000
IV-B	14,525,000	4,189,000	18,714,000

4. Selection of Alternatives for Further Comparisons

From Table 25, the alternatives are ranked in order of adjusted cost-effectiveness as follows:

Rank	Alternative	Total Present Worth ('79$)
1	III-B	$16,934,000
2	II-B	17,274,000
3	III-A	18,044,000
4	II-A	18,474,000
5	IV-B	18,714,000
6	I-B	19,284,000
7	IV-A	19,314,000
8	201's Selected Project	19,454,000
9	Expand Harold Street	20,506,000
10	I-A	21,084,000
11	Abandon Harold Street	24,814,000

In the remainder of this Chapter, the effects of the alternatives on the natural and man-made environment will be compared, with special emphasis placed on the major issues identified in the Notice of Intent. To avoid unnecessary bulk and repetition, however, only the 201's Selected Project, the No-Action Alternative, Alternatives III-B and II-B, and the Alternative to Expand the Harold Street Plant will be discussed in any detail. EPA regulations require that the impacts of the No-Action Alternative and the 201's Selected Project be evaluated in the EIS; Alternatives III-B and II-B were chosen for further discussion because they are the two least expensive projects; and the Alternative of Expanding the Harold Street Plant was chosen because it is the most cost-effective plan that would have any environmental consequences significantly different from those of Alternatives II-B, III-B, or the 201's Selected Project. All other alternatives were eliminated either for not being cost-effective, or for having impacts too similar to those of the alternatives being considered to warrant separate attention, or both.

C. EVALUATION AND COMPARISON OF IMPACTS

More detailed information is available concerning the 201's Selected Project than exists for any of the other alternatives being considered. Therefore, this evaluation will present a thorough analysis of the impacts expected to be caused by that project, and will then use that data for comparison with the impacts of the other alternatives.

1. Facilities Plan's Selected Project

[See Chapter III, Part B, Section 4b(6) for description of components.]

a. Air Quality. The primary short-term adverse air pollution effects include emissions from construction vehicles and dust caused by the excavation work and traffic. Since there is little development near the treatment plant site, impacts affecting residents will be minimal. Construction along interceptor routes through developed areas will have only minor effects. No short-term beneficial air quality impacts, nor any beneficial or adverse long-term impacts, are expected from operating the collection system and treatment plant.

b. Noise. Noise is an unavoidable temporary adverse impact of the construction of sewers and treatment facilities. Noise will be caused by operating construction equipment and blasting along sewer routes. Impacts along sewer routes through developed areas will be particularly annoying to the local residents, but those at the treatment plant will not be as severe because of its secluded location. The noise will only temporarily disturb the wildlife along sewer routes and at the treatment plant site. There are no beneficial short-term, nor any adverse or beneficial long-term noise impacts.

c. Odors. Odor emissions during construction will be minor and temporary. There are no major adverse nor beneficial short-term impacts. Odors may arise at the extraneous flow facilities at lift stations and at the treatment plant if sewage is retained for prolonged periods of time. Odors may occur at the treatment plant during breakdowns, but should have minimal effect on the surrounding environment due to the isolated location of the site. Proper operation of the lift stations and treatment plant will prevent emission of odors. The only beneficial long-term impacts anticipated will be the elimination of odors at the existing lift stations and temporary treatment facilities that will be abandoned.

d. Topography. Constructing a wastewater system consisting of a treatment plant, solids disposal area, holding basins, and sewer lines will alter the topography within the construction zones. Natural drainage at the plant site will be changed slightly. The treatment plant will be in an area that is presently vacant, and will permanently alter the land on which it is built. There will be some temporary erosion of exposed soils at the construction site, but only a relatively small, compact area will be involved. Constructing sewer lines will temporarily disturb small areas at a time, and is considered a minor impact. Blasting may be required where sewer lines are routed across rocky areas, such as the west side of Olathe Lake, Ernie Miller Park, and along 119th Street, but will result in only minor disruption of local land features.

e. Geology. Construction in bedrock will cause minor alterations of geological features. Sewer lines and foundations placed in rock will require its removal and off-site disposal. Because of the relatively small quantity of rock involved, no significant loss of commercial value is anticipated.

The natural gas fields in the area are at depths where the proposed facilities will not have an influence on, nor be influenced by, their presence. Limestone, sand and gravel resources could be removed and made commercially available, but the quantities involved are small, and would probably not prove economical. If suitable, these resources could be used in constructing the facilities.

f. Soils. When vegetation is removed within the construction limits, the soil is exposed to the erosive forces of wind and water until the vegetative cover is re-established. Subsurface soil layers will also be disturbed. Sewer trenches will be backfilled with excavated materials, so there will be little soil to be wasted. Sewer-line excavation may penetrate some of the more impermeable layers in the soil, thereby making it possible for surface water to percolate downward more easily. The adverse environmental effects on soil will be temporary during the construction period, except for permanent subsurface disturbance, which is not considered significant, except along the west side of Olathe Lake. The steep slope at that location will make it difficult to reestablish vegetation, and will allow a prolonged period of severe erosion into the lake.

g. Terrestrial Ecology. The most significant effects of the proposed project on the terrestrial ecology would be the primary adverse impacts on vegetation that would occur during the construction phase, especially along the west side of Olathe Lake and in Ernie Miller Park. Construction activities will affect a maximum of 148 acres. The vegetation cleared would include 12 acres of cropland, 90 acres of pasture and 46 acres of forest. Acreages are based on the total length of the interceptors and force mains, the maximum width of the corridor (100 feet), and the land necessary for the treatment plant and related facilities. Acreage impacted by laying associated sewage collection system lines is not included.

The impacts to herbaceous vegetation would be short-term. Cropland and pasture generally require only one or two years of revegetation to again become productive. Impacts on trees would be long-term, since reintroduced trees would require from 50 to 75 years' growth to restore present conditions. It would undoubtedly require a much longer period for trees to become reestablished on the bluffs on the west side of Olathe Lake, because of the nearly vertical face of the bluffs.

The most significant primary, adverse impact on wildlife resources would be the loss of habitat during construction. The greatest habitat loss would affect those species that utilize the earlier seral stages (transitory communities in ecological succession), including white-tail deer, cottontail rabbit, and a wide variety of songbirds and small mammals. The removal of grazing land would reduce the carrying capacity of the land, thus stressing local wildlife populations. Other impacts of construction would include the direct loss of relatively immobile species, such as amphibians, reptiles, ground nesting birds, shrews and moles. Larger, more mobile species may be temporarily displaced, but should return to adjacent areas after construction. The degree of damage to wildlife would depend on the time of year. During late spring and early summer, nests of small mammals and birds would be more likely to be destroyed than at other times of the year.

The wildlife that would be impacted is not unique to Kansas or the project area. There would be no known impact to either the critical habitat of State or Federally classified threatened or endangered species or the habitat of migratory waterfowl species.

Other primary adverse impacts to wildlife resources would be associated with routine construction operations: increased mortality because of increased vehicular traffic in construction areas; and disturbance of animals adjacent to construction sites due to noise and increased human activities. These represent temporary minor impacts to existing wildlife communities.

The corridors created in forested land by construction would create edge habitats. Following revegetation, these areas would provide food and cover for wildlife. Until revegetation occurs, however, the corridor would not benefit animals and might, instead, constitute a minor adverse impact by hindering the movements of small wildlife species that occur along the right-of-way.

Riparian wildlife habitat would also be impacted by construction activities adjacent to the streams. Wildlife species that occur in these areas, such as aquatic amphibians and reptiles, waterfowl, and riverine mammals, would be displaced or destroyed by these actions. Population losses may occur if animals are forced into marginal areas by competing species, where they are subject to predation. Familiarity with surroundings is a major factor affecting the survival of many species.

Impacts to Ernie Miller Park would include disruption of the bottomland woodlands by creating a temporary 80-foot-wide construction easement plus a 25-foot-wide permanent easement. To minimize impacts on existing vegetation, the gravity interceptor would follow the 20-25 foot wide abandoned railroad alignment through the park. However, this would not substantially reduce the severity of the effects of construction activities because there still would be adverse effects on an additional 55-60 foot width (totaling about 5.54 acres) beyond the existing railroad corridor. Impacts within the abandoned right-of-way would not be as significant as those occurring in the undisturbed natural area, because there is less acreage impacted (1.85 acres), and most of the vegetation consists of herbs, bushes, understory trees and a few large trees. Beyond the railroad right-of-way, the mature oak-hickory association would be adversely affected by the removal and damage of bottomland tree species. This would not only constitute a negative impact to the wildlife inhabiting this area and disturb the aquatic ecology of Little Cedar Creek by sediment loading from soil erosion, but would also destroy much of the the aesthetic appeal of the park.

The 25-foot permanent easement must allow equipment to be moved along the sewer to repair failures and perform maintenance. Therefore, revegetation would be limited to brush, grasses, and other cover types, and carefully staggered smaller understory trees (54). This should be sufficient to reintroduce wildlife to the corridor, as well as adequately replace the original understory structure along the abandoned railroad bed. However, the visual impacts on the mature woodland will be quite severe for 50-70 years, until the understory structure also matures.

Following construction, individuals, organizations and school classes using the area for study purposes could make the most of the disturbed area by studying plant succession, inter-action between established trees and those planted and growing in the disturbed area, soil differences caused by the disturbance, invasion and utilization of the corridor edge by wildlife, and other related areas of ecological interest. This would not, however, compensate for the loss, since the park already contains edge habitats.

Several secondary impacts resulting from urban expansion in the project area would also be expected. A population shift would occur from species that are sensitive to man and his activities, such as deer, fox, woodland birds, and most reptiles and amphibians, to more tolerant fauna, such as the chimney swift, starling, grackle, cardinal, robin, English sparrow, house mouse, Norway rat, garter snake, and American toad. An increase in road kills would also be expected due to the additional traffic in the area. Diversity and number of wildlife species would decrease because of the removal of den trees, cover, foraging and nesting areas and the increased proximity of human activities. Indirect impacts to vegetation include conversion of forested lands, cropland, and rangeland to residential developments. Although some communities are planned to blend into the natural setting, many turn out to be suburbs in the country. The lot sizes are usually small, and forest or other rural acreage is converted to lawns or the understory is removed. This type of development both removes most of the native vegetation and reduces the wildlife carrying capacity of the land. However, since the projected human population growth is expected to occur with or without the sewerage project, most of these impacts would occur, in any event. The sewerage system would decrease the total amount of habitat disrupted by allowing smaller lot sizes, but would, conversely, more thoroughly disrupt the habitat that was affected.

h. Water Quality. The 201's Selected Project will have definite adverse short-term impacts on the area's water quality during construction. Constructing sewers in and across creeks will temporarily increase turbidity and sediment. Constructing the proposed interceptor along the west side of Olathe Lake will cause a similar, more protracted degradation of the lake's water quality.

The proposed waste treatment plant will meet the Kansas effluent limitations for discharge to Class B waters. However, the effluent will still lower the existing quality of Cedar Creek by raising the BOD and suspended solids content of the stream slightly. The discharge is expected to have approximately the same overall impacts on Cedar Creek as the Harold Street plant's discharge has had on Mill Creek's water quality (see Appendix C-8).

Occasional system failures could also result in raw sewage entering Cedar and Little Cedar Creeks. Possible failures include: pipeline breaks and corrosive failures, power outages, mechanical equipment breakdown, sewer blockages, and operator errors. Although the effect of any of these failures would be temporary, the fact that they may happen at any time in the project's life makes them potential long-term impacts. Even though it is probable that such failures may occur several times during the design period, their effects will be less than those caused by the intermittent sewage overflows from existing lift stations.

Some beneficial long-term impacts from operating the proposed system can be expected because it will eliminate the present raw sewage discharges from the existing lift stations and a few failing septic tank systems. Also, improved effluent quality can be expected from the Harold Street plant due to the plant not continuing to be overloaded. However, it is difficult to assess whether these improvements would balance the impacts caused by introducing up to 3 mgd of even a treated effluent into a stream that presently receives a constant sewage discharge of less than 30,000 gpd from the Leeview Estates package plant.

i. Hydrologic Conditions. No short-term impacts on hydrologic conditions, either beneficial or adverse, are expected during construction. Even though adding up to 3 mgd of treated effluent to Cedar Creek will approximately double its existing dry-weather flow, the creek's channel is well-established, and no long-term adverse impacts from scouring, flooding, etc., are expected. If anything, adding a constant flow should slightly stabilize and improve the stream's hydrologic characteristics. Since most of this flow will come from future development in the Upper and Little Cedar Creek basins, little change will occur in the hydrologic characteristics of Mill Creek as a result of ceasing to pump sewage from the Upper and Little Cedar Creek basins to the Harold Street plant.

The fact that much of the proposed plant site and nearly all of the interceptor and force main corridors lie within the 100-year flood plain of Cedar and Little Cedar Creeks will require extensive design and siting efforts to protect the proposed facilities from flood damage, and to prevent the treatment plant from being overloaded by inflow during flood conditions.

j. Aquatic Ecology. Potential construction impacts to the aquatic ecosystem include temporary increases in the sediment loads and turbidity of Cedar and Little Cedar Creeks, which would adversely affect aquatic organisms. Silting eliminates the less mobile members of the benthic community in downstream reaches by suffocation or by impeding movement and feeding. Demersal (present on the bottom of the stream) eggs might also be buried. Turbidity prevents normal light penetration, thus hindering aquatic plant functions, and interfering with the feeding mechanisms of benthic invertebrates and of fish that seek out prey visually. It can also clog fish gills (58).

Some damage to fish spawning grounds would be expected, since the shallower headwaters of Little Cedar and Cedar Creeks provide suitable breeding sites for several fish species. Construction along the creek beds would alter the breeding sites so as to restrict or encourage the reproduction of certain species, and possibly eliminate some species altogether. Also, physical disruption of the stream beds by trenching at creek crossings would temporarily eliminate existing aquatic habitats and the associated benthic organisms and vegetation at those sites. Sections of streams that are altered by construction activities generally cannot support the number or the diversity of fish and benthic species found in an unaltered stream (59). Depending on the stream characteristics of the dredged areas, the time necessary for re-establishment of the aquatic fauna through stream succession would range from 6 to 24 months.

Construction activities on the west side of Olathe Lake would result in siltation of the reservoirs' waters. This will temporarily force fish to other sections of the lake, and may hinder the feeding and respiration of the benthic population in the immediate area. The east shore of the lake would biologically be a more desirable choice for construction, because its more gradual topography would make erosion less of a problem than on the steeper west bank.

The proposed waste treatment plant would discharge up to 3 mgd into Cedar Creek below its confluence with Little Cedar Creek when full capacity is reached. At that point, Cedar Creek maintains a steady dry weather flow of about 2 mgd. Thus, the treatment plant effluent would comprise a majority of the creek during periods of minimum flow. The effluent will have been subjected to secondary treatment, and will meet the NPDES permit limitations for biochemical oxygen demand (BOD), suspended solids (SS) and reduction of fecal coliform bacteria. However, the remaining pollutants may still limit the diversity of benthic and fish species inhabiting Cedar Creek.

Chlorine would probably be used to disinfect the sewage. For proper disinfection, domestic sewage treatment plants usually maintain a residual chlorine level of 0.5-2.0 ppm (60). Chlorine concentrations as low as 0.01 ppm have a detrimental effect on the survival and reproduction of aquatic life (66). Fish are known to avoid sections of streams where total chlorine is 0.37 ppm, and a species diversity of zero has been observed at a concentration of 0.25 ppm (60). In a study to determine chloramine toxicity with crayfish, *Orconectes nais*, and orange-throated darters, *Etheostoma spectabilis*, both collected in Cedar Creek, 96-hour Median Lethal Concentrations (96-hour LC_{50}, the concentration of a substance killing 50 percent of the test organisms within 96 hours of exposure) of 0.76

ppm and 0.39 ppm, respectively, were recorded (113). Therefore, a stream with as small a dilution capacity as Cedar Creek most probably will not be able to support many organisms immediately below the outfall. The distance in which the effect of chlorination is felt downsteam will depend on a number of factors, including the volume and velocity of the flow, the actual chlorine concentration, and the volume of the discharge. The worst conditions would occur during low flow periods during which a comparatively high volume effluent is combined with a high chlorine concentration.

The BOD_5 during low flow conditions in Cedar Creek would approach a maximum of 30 mg/l, the BOD_5 level in the effluent. A high BOD_5 concentration (above 10 mg/l) over an extended duration, may reduce the DO enough to have a significant adverse impact on the aquatic community. The treatment plant effluent will usually have a lower DO level than that of the receiving stream. The situation most stressful to aquatic biota below the treatment plant outfall would be a period of both high temperature and low stream flow. At this time, the DO level may fall well below 5 mgl, the minimum concentration to maintain a good fish population. While fish can survive lower DO values, they will tend to avoid oxygen-deficient areas. During the summer months, DO levels are depressed to 3.5-5.6 mg/l in Cedar Creek, and to 2.8-5.8 mg/l in Mill Creek. Such temporary seasonal DO reductions probably have no lethal effect on the aquatic fauna; however, if these reductions occurred in the spring, reproduction of benthic macroinvertebrates and the hatching of fish fry would be reduced or eliminated. A permanent DO reduction caused by a constant discharge may cause a shift in species composition, with more sensitive species being replaced by species tolerant of reduced oxygen levels.

Thus, although the NPDES permit limitations will be met, it is likely that pollution-tolerant insects will proliferate, and that fish life will be eliminated, or reduced to rough fish, below the outfall. The distance these impacts will be felt is dependent on the distance required to reestablish sufficient oxygenation through dilution and natural purification, which could be several miles below the outfall.

To the minor extent that urban expansion would increase within the project area as a result of the project, several secondary impacts would occur, including: increased rate and volume of runoff due to the additional streets and other impermeable surfaces, bringing with it vehicular residues; increased salt from ice control measures; increased pressure for recreational uses of the stream; and increased industrial development and its related waste products. These impacts are not compatible with a healthy aquatic environment, and will further reduce the diversity of the aquatic community.

k. Population and Land Use. There would be no direct impacts on the population due to constructing or operating the 201's Selected Project. It would not be necessary to relocate any existing dwelling units for right-of-way acquisition.

Assuming a 100-ft.-wide temporary construction easement, a 25-ft.-wide permanent easement, and that 10 acres would be permanently retired for the plant site, approximately 148 acres of land would be affected by construction, and 46 of these acres would be permanently impacted. About 102 acres of agricultural land would be temporarily impacted. This land could be restored to its original use at the end of the construction phase. About 46 acres of forest would be permanently impacted, and only the woodlands outside of the permanent easement could be restored because of the need to maintain access to the interceptors.

Stage I construction would serve the Little Cedar Creek basin, where the pressure for development is immediate. Stage II would serve the portion of Upper Cedar Creek south of the north end of Olathe Lake when population growth indicates this service is needed, and Stage III would increase capacity to handle the additional population growth projected for both basins. By staggering the construction of the project throughout the design period, the adverse impact of promoting uncontrolled growth is substantially avoided.

Several beneficial impacts would result from Stage I of the 201's Selected Project. Residential construction is an ongoing activity in the Little Cedar Creek basin, especially within the City Limits of Olathe. Providing public sewers to this area would change the current scattered development pattern to a more compact, orderly development pattern by making it more economical for a potential subdivider to locate within the tributary area of the interceptor. This pattern would result in less land being retired from vacant or agricultural uses to accommodate the projected population growth than would the present pattern of scattered larger lots. However, the major adverse long-term impact would still be the loss of prime agricultural land to urban expansion. Approximately 800 prime agricultural acres would be converted for residential use in the Little Cedar Creek basin. This is not significant, from the large-scale viewpoint, because it represents only a very small portion of the total amount of prime agricultural land in the KCMR. However, it does contribute to the overall land use conversion taking place throughout Johnson County.

Stages II and III of the 201's Selected Project would also have several beneficial impacts in the Upper Cedar Creek basin. By the time Stage II is completed, Johnson County is expected to have a revised and up-to-date zoning ordinance and a comprehensive plan. These will enable the County to control the geographical location and the density of the additional population which would move into the service area. The major impacts in the Upper Cedar Creek basin would be a slight acceleration of population growth above what would occur without the project, and the concentration of this growth within the area tributary to the interceptor. There would be no land use impacts in the Upper Cedar Creek basin north of Olathe Lake, since the force main proposed through that area would not readily allow residential connections.

1. Economic Impacts. Constructing and operating the proposd project will have several impacts on the economy of Olathe. These include short-term construction impacts and long-term impacts on individual system users.

Spending more than $14,000,000 for construction activities by 1990 will have a temporary beneficial effect on the construction industry in the Olathe area. Spin-off effects of these expenditures will increase these economic impacts. On a state-wide scale, however, this impact is negligible, since the Federal funds would be spent elsewhere in the state, if not used on this project, and would have similar beneficial impacts on the economy of the other area.

Economic impacts on system users consist of three principal factors: user charges for operation and maintenance of the system, user charges to recover local capital costs, and one-time costs for connection to the system. Annual operation and maintenance costs are estimated to be approximately $22 per capita in 1990, or about $61 per household. Annual debt service on the revenue bonds used to finance the local share of construction costs is estimated to be approximately $89 per capita, or $267 per household in 1980, based on an assumed interest rate of 7.5 percent on a 20 year bond, and using the entire present service area population. Although these costs are not inordinately high, they are higher than would be the case if the system were downsized to meet EPA's eligibility criteria. This constitutes a minor adverse economic impact, since a downsized system would be adequate to handle all flows generated during the useful life of the project components.

Guidelines have been developed by the Federal government (67) to identify sewerage projects likely to have significant adverse economic impacts on system users. These upper-limit guidelines for annual user charges are:

- 1.5% of the median household income in communities with median household incomes less than $6,000
- 2.0% of median household incomes between $6,000 and $10,000
- 2.5% of median household incomes greater than $10,000

The estimated median household income in Olathe is over $19,000, and the guidelines therefore indicate an upper limit of approximately $475 for annual user charges, which is well above the charges projected for the proposed project. The proposed project, by itself, should, therefore, impose no financial burden on most of the residents of the community. There will be some impact on those households in the lowest economic strata, but these should not be severe or extensive.

For those residences in the project area not already connected to a public sewage collection system, there will also be a one-time charge for connection to the proposed system. This cost is expected to range from $300 to $1,000, depending upon the characteristics of the individual lots and the distance to the collection sewer. Since the proposed project includes only interceptor sewers, those residences not already in the service area of a collector sewer will also be required to pay their share of the cost of constructing collector sewers. For new subdivisions, this cost will probably be borne by the developer, and passed on in the cost of the houses sold. For existing residences, some form of special assessment would most likely be used. This cost will also vary, depending upon lot size and assessment method used, and is estimated to be in the vicinity of $1,500 - $2,000 per lot. These two one-time charges, when added to the cost of the proposed project, could cause substantial hardship for a limited number of study area residents, depending upon the financing schemes made available by the City.

The method of assessment used to recover the local capital costs could produce some minor adverse economic effects on owners of land presently used for farming. If property is assessed on either a sewer frontage or an acreage basis, whether or not it is presently residentially developed, the costs to the landowner could easily be high enough to create unwarranted pressure to sell the land.

A further adverse economic impact that could have long-term effects is caused by the selected project, as described in the Supplement to the Facilities Plan, not including all the costs associated with accomplishing its stated goals. As discussed in detail in Part B of this Chapter, the $12.68 million present worth given for the proposed project is understated by almost $6.8 million, or more than 50%, if all necessary elements are taken into consideration. These costs, if not included and budgeted for, would place a severe strain on the City's financial capabilities. Further, if no grants are obtained for this work, the additional cost to local users could cause severe hardship for a significant number of residents.

m. Archaeological, Historical and Recreational Resources. Constructing the proposed sewerage facilities could affect a number of archaeological sites, as much of the work planned is in the Upper Cedar Creek valley, where the majority of sites are located. In addition to disruption by actual construction, heavy equipment traversing ground adjacent to construction areas could scar the ground surface, thereby damaging cultural resources. Thirteen of the twenty identified sites are within a proposed interceptor or force main corridor, including four of the sites (14J0505, 14J0514, 14J0515, and 14J0521) with potential eligibility for inclusion on the National Register of Historic Places, and six of the sites potentially eligible for the Kansas Inventory of Historic Sites. Four additional sites are near a proposed corridor. The fifth site having potential National Register status (14J0507) is slightly north of the planning area.

There are two main clusters of sites along Upper Cedar Creek which have the greatest potential for impact. One is around site 14J0505, the second is near the confluence of Cedar Creek and Little Cedar Creek. Full significance and information potential have not been determined for most of these sites.

In Kansas, Archaic and Plains Woodland sites are commonly found well beneath the surface. Thus, buried prehistoric resources may be encountered during trenching for interceptor or force main lines, especially in alluvial deposits along stream valleys. The relatively shallow alluvial deposits in the Cedar Creek, Little Cedar Creek, and Mill Creek valleys somewhat lessen this prospect.

None of the twenty-nine historic buildings are either directly or indirectly threatened by construction of the proposed sewerage facilities. However, one historic site, the Sante Fe Trail Ruts, faces potential adverse impact, since the trail segment crossing Cedar Creek is within an interceptor corridor. Another historic site which would be affected by construction is the Old Calamity Railroad, which was built in 1871. If the proposed alignment through Ernie Miller Park is followed, remains of the railroad bed will be destroyed. However, this site is not considered significant because of its present poor condition.

The only major direct impact upon recreational resources due to the implementation of the 201's Selected Project would be the impacts to Ernie Miller Park. These impacts are assessed in g, above.

The major indirect impacts on recreational resources would be an increase in the use of existing parks and an increase in the demand for additional facilities. Several local parks are proposed in the Persimmon Hills Planned Residential District and in the City of Olathe's Comprehensive Plan, so it is evident that the City is aware of the potential need for additional facilities. The County, because it has just become involved in a planning process, has not assessed this problem. However, it is likely this problem will be considered in the new Comprehensive Plan.

n. Transportation. Some temporary traffic interruptions will be caused during construction, especially where the proposed interceptors and force mains are built in, near, or across major arterials, such as Highway K-7 and Sante Fe. There will be little of this sort of work, however, since most of the proposed work will follow the creek alignments. Movement of construction equipment and materials will also cause some interruption of normal traffic movements. Unless extreme precautions are used, building the interceptor proposed along the west side of Olathe Lake could result in extended closure of the road there; however, only a few persons would be seriously affected. Improving 119th Street to provide all-weather access to the treatment plant site, which includes rebuilding two demolished bridges over Little Cedar Creek, will be a permanent direct, beneficial impact; but will also be very minor, because of the small number of persons affected.

To the minor extent that the project will induce and accelerate the anticipated population growth in the study area, it will be responsible for the adverse secondary impact of generating additional traffic volume on the street and highway network. This growth will be consistent with the City's desire to equalize its population between the east and west sides of town, and will help prevent traffic congestion east of I-35 from becoming worse. However, since none of the major street and highway improvements needed to relieve present congestion or to provide alternate routes north from the study area are likely to be implemented before 1990, the present conditions elsewhere are unlikely to improve. In fact, the additional traffic crossing town from the study area to I-35 will aggravate existing problems all along Santa Fe, and especially at the interchange with I-35, where even more vehicles will be trying to turn left across the heavy westbound traffic flow.

o. Resource Use. The project will not greatly interfere with the development of any mineral resources. There are presently no mining operations along the proposed pipeline corridors or at the waste treatment plant site. While a small amount of limestone would be removed by constructing the project, it would be a very small percentage of the total available. The proposed pipelines cross the Olathe Gas Field, and the plant is over the Olathe North Gas Field. Both fields have potential for use as gas storage areas, even though relatively inactive at the present time. Since the gas fields are found in the Pennsylvanian Sandstone, at depths of 500 feet, the project is not expected to cause any adverse impacts. (86).

Construction in the interceptor and force main corridors would necessitate clearing some trees that may be commercially valuable. At most, this timber loss would be 46 acres, of which 12 acres are within the permanent right-of-way. The sewage treatment plant site will occupy about 10 acres of bottomland hardwood forest. The impact to the area's forest resources from removing these woodlands would be minimal. Neither the temporarily nor the long-term impacted acreage will remove any commercially logged land from production. The project would remove less than 1 percent of the existing forest resources in the Cedar Creek basin.

The temporary loss of wildlife habitat by the project would slightly decrease the carrying capacity of the land for game, furbearing, and other commerically and recreationally important species. This should insignificantly reduce the hunting and trapping harvest in the study area. Where the 25 foot permanent easement passes through woodlands, an edge habitat would be created, most likely increasing the diversity in the area once the corridor is revegetated. Sport fish would be vastly reduced in all of Little Cedar Creek and about half of the length of Cedar Creek by construction and operation impacts of the project. Since these creeks do not support a significant sport fishery, this impact is also minimal.

The proposed interceptor routes along Little Cedar and Cedar Creeks will disrupt about 140 acres that are classified by the USDA Soil Service as prime farmland. This is about 1 percent of the entire cropland acreage in the Cedar Creek watershed. Of this total, only 12 acres are presently being used for crop production; the remainder is rangeland or woodland. The permanent easements passing through agricultural land would not preclude continued farming, and the construction impacts would last for only one growing season. However, variables such as the specific route location, the time of year that construction occurs, the revegetation program, and maintenance procedures will ultimately determine the degree to which these short-term impacts affect the area's long-term productivity.

p. Water Supply. No direct adverse or beneficial impacts to the area's underground water supplies will be caused by implementing the 201's Selected Project because of the distance of the well field from the study area. Constructing the proposed interceptor around the west side of Olathe Lake will cause considerable turbidity in the lake's waters unless extensive precautions are taken to avoid erosion. Such turbidity could cause slightly increased treatment costs during the construction period, or could require that the City temporarily discontinue using the lake as a water supply to avoid these costs, neither of which would constitute a major impact, since the City's underground supplies alone are more than adequate.

No adverse or beneficial secondary impacts are anticipated to be caused by the slight acceleration of the population growth attributed to the proposed project, because water production, treatment, and distribution capabilities are adequate to meet future demands.

q. Wastewater Management Programs. The goals of the 201's Selected Project are in accordance with the 208 and 303 plans for the KCMR and the Kansas River basin, respectively, as well as with other previous long-range planning for the Cedar and Mill Creek basins. The project should, therefore, have no major adverse effects on regional wastewater management programs. However, since the project, as proposed, does not include all the work necessary to achieve its stated objectives (see Part B, this Chapter), it will have the impact of requiring considerable additional program planning and implementation effort during the project design period to correct this shortcoming. This effort could easily delay attainment of the project's goals. Failure to correct the project's shortcomings could result in a repetition, within the design life of the project, of the primary pollution problem it was intended to solve, the overloading of the Harold Street treatment plant.

There would be a slight beneficial impact on the programs of the Johnson County Unified Sewer District if all the project's goals are met. Keeping the Harold Street plant in service for the next 20 years would allow time for sufficient development to occur in the Mill Creek basin north of Olathe to warrant construction of the major plant proposed in previous planning. That plant could then relieve the Harold Street plant and serve all of the southern parts of the Mill Creek basin. The project would also eliminate the present inter-basin sewage transfers, which would also be in keeping with earlier long-range plans described in Chapter II, Part B, Section 7 (4, 5, 93).

r. Water Rights. The 201's Selected Project should not affect water rights claims on Cedar Creek. There are at present no water rights registered with the Kansas Division of Water Resources on Cedar Creek below the proposed treatment plant site. Since the proposed project will increase the flow in Cedar Creek by adding disinfected, treated effluent, there should be beneficial effects for any parties downstream that use the stream for irrigation.

s. Community Services and Facilities. While providing sewerage services in the Little Cedar and Upper Cedar Creek basins will induce some residential development earlier than would otherwise occur, the staging and layout of the system will lessen the impacts on Olathe's ability to provide community services. The City is presently trying to encourage development in its western areas to balance the heavy growth along Interstate 35. Other projects, such as the proposed construction of Highway K-12 from K-10 to I-435, will also attract development to this area, and help provide this balanced growth, when implemented.

Planning in the City of Olathe reflects this intention to achieve more geographically balanced growth. Land has been set aside for a new fire station in the Persimmon Hills area, and a new elementary school is expected to open there in 1980. Land has also been acquired for a second new elementary school in the study area.

The proposed interceptors will provide a focus for the residential development expected in the area, and will foster a more structured, compact, and predictable pattern of growth. This will facilitate constructing roads and other utilities more than would a pattern of scattered developments with independent sewerage facilities. Growth in the study area will also draw future development away from eastern Olathe areas and thereby reduce future burdens on roads and utilities in those areas.

Electric and natural gas utilities foresee no problems in expanding their services in the western part of Olathe. The utilities have been expecting rapid residential growth in the area and all believe they have the capacity to meet projected demands (108, 109).

Secondary impacts on community services and facilities are, therefore, not expected to be severe in the study area. As in any community undergoing rapid growth, there will be some growing pains as public services attempt to keep pace with the residential developments produced by the less-restricted private sector. However, with the relative affluence of the area and the near-term prospect of an updated County zoning ordinance and comprehensive plan, the area is well able to accommodate the expected future growth.

t. Taxes and Budgeting. Local capital costs of the proposed system will be financed through revenue bonds issued by the City of Olathe. Olathe's latest issue of revenue bonds, in August, 1978, received an A rating. Since there is no statutory limit on the amount of revenue bonds a city may issue, Olathe should have little difficulty marketing bonds for the proposed project. The sewer bonds will be retired entirely through user charges, so there should be no direct effect on the City tax rate as a result of the proposed project. To the minor extent that the 201's Selected Project induces growth in the study area, this growth will increase the City's tax base, helping to offset the costs of providing community services.

Adding a second major treatment plant to the City's system will considerably increase the budgeting effort, and will add considerably to the work required to set and collect sewer user charges. However, both these functions are already a part of the City's normal routine, and only an extension of present procedures will be needed to accommodate the new workload.

u. Implementability. Olathe unquestionably has the legal authority to acquire sites and rights-of-way, and to construct sewerage facilities, outside its corporate limits. The City may not, however, form sewer benefit districts outside its boundaries to provide service to, and collect user charges from, residents of unincorporated areas without special permission from the County. It is unlikely that such permission will be granted, since all long-range planning calls for eventual consolidation of all area sewerage works, including Olathe's, under the Johnson County Unified Sewer District. This presents a problem, considering that the project is predicated upon serving the entire population of the study area, and that about two-thirds of the project area is presently unincorporated.

There are two basic ways for Olathe to legally provide sewerage service to residents of the presently unincorporated areas. One way is for the City to annex the areas in question, either voluntarily or involuntarily, and then form City sewerage benefit districts. The second is for the County to form benefit districts for collecting sewage, and then contract with the City for treatment at the new plant. Unfortunately, although relations between the City and County governments are reportedly quite amicable, no action has been taken to date to draft an inter-governmental agreement stipulating which procedure will be used.

A sizable minority of the residents of the unincorporated parts of the study area have expressed opposition to the project. Among their principal concerns are preventing high-density development in the study area, avoiding involuntary annexation by the City, avoiding being forced to accept sewerage service, and avoiding involuntary assessments for the project's costs, especially if they are not served. These residents are adamantly opposed to the project, and, through litigation and political action, could cause considerable additional delay in implementing the project. No course of action except selecting the No-Action Alternative is likely to completely eliminate opposition to the project. However, if residents could be assured that annexation would not be necessary and that capital costs would not be assessed against unconnected property, it would considerably reduce the amount of opposition, and could avoid significant additional delay.

2. No-Action Alternative

Should EPA deny further funding for the proposed project or any of its alternatives, it is deemed most likely that the City would pursue the option of minimum work plus numerous small treatment facilities, as described in Chapter III, Part C, Section 4. Because of the uncertainties involved in predicting the timing, location, and size of development under this alternative, precise quantification of its impacts is extremely difficult. Therefore, qualitative comparisons of its impacts to those of the 201's Selected Project were made, as they relate to the major issues of this EIS.

a. Ernie Miller Park. Since there would be no major interceptors involved, and no development would encroach upon the park, there would be no beneficial or adverse impacts upon Ernie Miller Park as a result of adopting the No-Action Alternative.

b. Population Growth and Land Use Changes. The projected population growth in the study area is expected to occur during the design period, whether or not the proposed project is constructed. Adopting the No-Action Alternative would probably cause the majority of this growth to shift more towards the end of the design period, because of the lead time necessary to formulate a management plan and to acquaint developers with the procedures to be implemented. This delay would benefit the study area's transportation network by placing most of the population growth closer to the time when needed street and highway improvements will be made. However, the housing shortage during the early part of the design period would cause higher prices, and would further development east of I-35.

The generally lower-density, more-widely scattered development pattern expected under the No-action Alternative will have the adverse secondary effect of retiring considerably more land to provide housing for the projected population growth than would the more compact and orderly pattern that would prevail under the 201's Selected Project. To illustrate, assuming nothing but single-family residences, at 3 persons per household, the 12,000 persons expected to locate in the Cedar and Little Cedar Creek basins during the design period would require 4,000 acres for housing alone if the lot sizes averaged one acre, but would only require about 1,400 acres if the average lot size more nearly approached the 15,000 square foot minimum size allowed for sewered developments. The lower density development pattern would also inhibit the ability to provide other community services (schools, fire and police protection, and utilities) because of the higher costs per household.

The amount of land directly taken for sewerage facilities under the No-Action Alternative cannot be determined because of the inability to predict what kinds and sizes of treatment facilities would be built. If the 12,000 new residents of the Upper and Little Cedar Creek basins were all served by lagoons, a minimum of 70 acres would be required for lagoon surface area alone. Adding the land needed for embankments and other plant site requirements would bring the total to about 100 acres that would be permanently retired. This compares to the 46 acres that would be permanently taken, plus another 102 acres that would be temporarily impacted, under the 201's Selected Project. This 100-acre estimate would be increased by any facilities built for presently unsewered populations, and decreased by any use of less land-intensive treatment facilities, such as package treatment plants, or by use of on-site systems.

c. Cultural Resources. Adopting the No-Action Alternative would greatly reduce the possibility of disturbing the archaeological sites identified by the cultural resources survey, since there would be no need for a pipeline along Upper Cedar Creek, or for a treatment plant at the juncture of Upper and Little Cedar Creeks, and because it would be relatively easy to locate the small facilities to be built away from the known sites. Since that survey is believed to have located about 80% of all such sites in the study area, there is little likelihood that any of the treatment facilities built under the No-Action Alternatives would impact a presently unknown site either.

d. Need for Other Alternatives. Adopting the No-Action Alternative would have a minor beneficial effect on the wastewater management programs for the region, in that the need for a centralized collection and treatment system would be postponed until after much of the growth predicted for the area had occurred. This would allow more accurate sizing and location of system components, as well as more time to thoroughly develop management system alternatives that would encompass the problems of the entire study area. Also, by that time, sufficient development may have occurred north of the study area to warrant building the major treatment plants that are envisioned in the long-range plans for the Cedar and Mill Creek basins. This would eliminate the need for an interim plant at Cedar and Little Cedar Creeks, and would allow abandonment of the Harold Street plant. There would, however, be an offsetting adverse impact caused by the need to quickly develop and implement a management program to provide for the private construction and public operation and maintenance of the numerous small plants to be built.

e. Erosion, Siltation, Flood Damage, and Sludge Disposal. Erosion and siltation during construction would be slightly worse under the No-Action Alternative than under the 201's Selected Project, since more land would be exposed by construction. However, impacts at any given point would be small because of the smaller size of the sites, and the total impact would still be minor.

The potential for flood damage and the need to protect interceptors from inflow during floods would also be greatly reduced by choosing the No-Action Alternative. Most of the new facilities would be further upstream, where flooding affects smaller portions of the creek valleys, which would facilitate site selection, and there would be no interceptors.

Sludge disposal would require even less spreading area or landfill volume under the No-Action Alternative than under the 201's Selected Project, because the treatment processes commonly used for such small facilities (lagoons and extended aeration package plants) usually generate less waste sludge per capita than the oxidation ditch process. However, the scattered locations of the treatment plants would require inefficient collection and transportation procedures, if a central disposal site, such as the City landfill, were used.

f. Implementability. If the No-Action Alternative were to be chosen, opposition to the project from residents of the unincorporated areas would probably be eliminated. However, it is the policy of the State of Kansas to discourage the proliferation of numerous small treatment facilities (94) because of the past record of inadequate operation and maintenance of such installations. Also, since the overall cost of this alternative cannot be accurately estimated, it cannot be demonstrated to be cost-effective. Both of these problems would weigh heavily against State or EPA approval of this alternative, and would also lead to considerable delay in formulating an acceptable management system. Another problem is caused by the No-Action Alternative being predicated upon the City operating and maintaining only these facilities built within the City Limits, with the Johnson County Unified Sewer District assuming responsibility for plants built in unincorporated areas. Since the USD is not a party to the present Facilities Plan, considerable additional time would be needed to obtain their concurrence and to coordinate the management system with them, causing even more delay before this alternative could be implemented.

g. Olathe Lake. Adopting the No-Action Alternative would avoid the deforestation and subsequent severe erosion along the west side of Olathe Lake that would occur under the 201's Selected Project, since the interceptor proposed for that location would not be built. Any discharging lagoons, package treatment plants, or inadequate on-site systems constructed upstream of the lake, however, would have a slightly adverse impact on its water quality. The nutrients in the discharges and leachate from such facilities could accelerate the lake's eutrophication rate slightly.

h. Other Impacts Not Related To Major Issues. The vast majority of the study area's soils are considered unsuitable for septic tank installations. To avoid degradation of water quality and the attendant public health hazards, rigid enforcement of the Johnson County Health Department's rules governing such installations would be required, as well as some method of ensuring correction of the few existing septic tank system failures.

Although the effluent from package plants would contain 30 mg/l each BOD and suspended solids (SS), any discharging lagoons built would be allowed to release 30 mg/l BOD and 80 mg/l SS. When SS increases to 80 mg/l, the density of macroinvertebrates downstream decreases significantly, because pollution-sensitive forms disappear (69). Additional suspended solids would also increase the number of undesirable algal forms and, along with the suspended materials, would reduce the depth of light penetration (70), decreasing available fish food. Thus, while the No-Action Alternative would avoid the direct impacts of pipeline construction along Cedar and Little Cedar Creeks, the lower quality effluent from lagoons would produce long-term adverse impacts on the water quality and aquatic ecology of both streams, compared to the 201's Selected Project, and over greater lengths.

3. Facilities Plan Alternative III-B

This project is the most cost-effective of all the alternatives examined. Its impacts would be very similar to those of the 201's Selected Project because the interceptors and force mains proposed, though smaller, would follow the same alignments, and because the treatment plant would be identical. See Chapter III, Part B, Section 4b(3 and 5) for a description of its major components.

a. Ernie Miller Park. The impacts on Ernie Miller Park under Alternative III-B would be essentially the same as those of the 201's Selected Project. Although the interceptor pipe size through the park would be slightly smaller, the construction and permanent easements, and the damage done during construction, would remain the same.

b. Population Growth and Land Use Changes. This is the area of major difference, other than cost, between Alternative III-B and the 201's Selected Project. Essentially the same amount of land would be directly retired from present uses. However, as discussed in

Part B, Section 2 of this Chapter, Alternative III-B would not allow gravity collection of sewage from residents in the Little Cedar Creek basin north of the City Limits, or from residents of the area tributary to Little Cedar Creek west of the landfill, which includes the Persimmon Hills development. Both of these areas would be served by the 201's Selected Project. Omitting these areas, coupled with constructing the Upper Cedar Creek interceptor and force main, would have the effect of creating much higher development densities in the southern portion of the Little Cedar Creek basin than would otherwise be anticipated. It would also "steer" development of vacant land toward the Upper Cedar Creek basin, most of which is unincorporated, rather than towards the Persimmon Hills area, which is already under development, and within the City Limits. This latter effect is considered a significant adverse impact, as it would promote the "leapfrog" development pattern that leads to inefficiency in providing other community serves. Also, because of the large proportion of the study area that would not receive service under Alternative III-B, a shift in the timing of the population growth towards the end of the design period would be expected, similar to that of the No-Action Alternative, but less pronounced.

Choosing Alternative III-B instead of the 201's Selected Project would eliminate much of the excess capacity available in the latter projects' interceptors. Although it would be difficult for that capacity to encourage growth in the study area because of the limitations imposed by the lift station and treatment plant sizes, eliminating it entirely would have the minor benefit of making unrestrained growth much more difficult.

c. Cultural Resources. The impacts caused by Alternative III-B on archaeological and historial sites would be identical to those of the 201's Selected Project.

d. Need for Other Alternatives. As was discussed in detail in Part B of this Chapter, Alternative III-B is like the 201's Selected Project in that it does not include all the work necessary to solve the existing pollution problems throughout the design period.

In addition, since it would not collect sewage from the Little Cedar Creek basin north of the City Limits or from the Persimmon Hills area, even more work would be necessary for Alternative III-B to achieve its goals than for the 201's Selected Project. This is considered a major adverse effect of this alternative on the area's wastewater management programs, because once Alternative III-B is built, the City would be severely restricted in the alternatives available to solve the remaining problems.

e. Erosion, Siltation, Flood Damage, and Sludge Disposal. The impacts in these areas caused by building Alternative III-B would be nearly identical to those caused by constructing the 201's Selected Project. The only difference would be that there would be no need to protect the pipeline along Little Cedar Creek north of the City Limits from inflow during floods, since it would be a force main, rather than a gravity interceptor.

f. Implementability. If Alternative III-B were to be chosen, there would probably be a significant reduction in the amount of opposition received from residents of the unincorporated parts of the study area, because of the greatly reduced service area. Some opposition would remain, however, because unincorporated areas south of Olathe Lake would still be served. There would also still be considerable apprehension that County residents would be required to pay a share of the project's capital costs, simply by virtue of being in the study area, even though they would be unable to connect to the force mains passing through their property. Conversely, the reduced service area would also increase the difficulty of implementing this alternative. KDHE has already formally requested that the City modify its original project to allow gravity sewer service to the new developments in the Persimmon Hills area (See Chapter I, Part B, Section 3), and it is considered unlikely that KDHE would now approve an alternative that does not include service to that area.

g. Olathe Lake. Impacts to Olathe Lake under Alternative III-B would be essentially identical to those caused by the 201's Selected Project.

h. Other Impacts Not Related to Major Issues. Impacts on water quality and terrestrial and aquatic ecology under Alternative III-B would be essentially identical to those caused by the 201's Selected Project. Other than the land use and implementability impacts discussed above, the only major difference between Alternative III-B and the 201's Selected Project would be in their economic impacts. Alternative III-B uses smaller interceptor sizes (which are still more than adequate to handle all flows generated during the design period), and replaces most of the Little Cedar Creek interceptor with a force main, which is less expensive to install. This results in a considerably less costly project, but one which will require expansion sooner (although beyond the design period). The lower project costs would, of course, reduce the assessments to individual users. This benefit would be further enhanced because, since the pipe sizes are smaller, a larger percentage of the costs would be grant eligible.

Alternative III-B, is, however, much more energy-intensive than the 201's Selected Project, since it pumps all sewage to the treatment plant, rather than just that generated in the Upper Cedar Creek basin. Given the uncertainty of the present national energy situation, rising energy costs could easily reduce Alternative III-B's apparent cost advantage significantly during the design period.

4. Facilities Plan Alternative II-B

This project is the second most cost-effective of the alternatives examined, having an adjusted total present worth (see Table 25) only $340,000 more than that of Alternative III-B, and still $2.18 million less than that of the 201's Selected Project. Its impacts are also very similar to those of the 201's Selected Project, because it also proposes pipelines along the same routes, and an identical treatment plant. A description of its major components can be found in Chapter III, Part B, Section 4b(2 and 5).

a. Ernie Miller Park. Impacts to Ernie Miller Park from building Alternative II-B would be identical to those of Alternative III-B.

b. Population Growth and Land Use Changes. Alternative II-B incorporates gravity interceptors along the entire length of both Upper and Little Cedar Creeks, and would facilitate gravity collection of all sewage generated in the study area. However, the amount and location of land directly retired for the sewerage facilities would be the same as that taken under either Alternative III-B or the 201's Selected Project. Serving the entire study area by gravity, in stages, as proposed, would allow relatively high-density development to progress in an orderly fashion throughout the study area, but without the unwarranted "steering" or the undesirably high population densities in a few areas that would result from choosing Alternative III-B. It would also help attain a more constant, manageable growth rate, with no shifts of high population influx toward either end of the design period. Since this alternative's interceptors use the same lower design flows as Alternative III-B, the slight possibility of unrestricted growth being induced by available excess capacity would be greatly reduced, compared to the 201's Selected Project.

c. Cultural Resources. Alternative II-B would have impacts on cultural resources identical to those of the 201's Selected Project.

d. Need for Other Alternatives. Since Alternative II-B, as proposed, would serve the entire study area by gravity, it would require less additional work to meet the goal of solving the area's existing pollution problems than would either Alternative III-B or the 201's Selected Project (see Part B, this Chapter).

e. Erosion, Siltation, Flood Damage, and Sludge Disposal. The impacts in these areas caused by building Alternative II-B would be practically identical to those of building the 201's Selected Project, except that a greater length of gravity interceptor would have to be protected against inflow.

f. Implementability. Adopting Alternative II-B would not result in significantly reduced public opposition to the project, since no residents of unincorporated areas would feel less threatened by City annexation and taxation, and no development would be curtailed by the project's configuration. On the other hand, both KDHE and EPA could more readily support this alternative as being a cost-effective, non-growth-inducing solution to the area's existing pollution problems than they could the oversized 201's Selected Project.

g. Olathe Lake. Impacts to Olathe Lake under Alternative II-B would be essentially identical to those of the 201's Selected Project.

h. Other Impacts Not Related To Major Issues. Impacts on water quality and terrestrial and aquatic ecology under Alternative II-B would be essentially identical to those of the 201's Selected Project. As with Alternative III-B, the major benefit to this alternative, compared to the 201's Selected Project, is that it is less expensive, largely because of the smaller pipe sizes employed. This would reduce the financial burden to be carried by the City and the residents of the study area. Compared to Alternative III-B, this project is only slightly more expensive, and, considering the energy-intensive nature of Alternative III-B's two major lift stations, as compared to this project's total gravity system, it is questionable whether the difference is significant. This question is further reinforced by the fact that this project would serve the whole study area, as intended, whereas Alternative III-B would not.

5. Expand the Harold Street Plant

This project is the least cost-effective of the alternatives selected for further evaluation, having a total adjusted present worth more than $1 million above that of the 201's Selected Project. However, because it has a different configuration, with no force main along Upper Cedar Creek north of Olathe Lake, and no new treatment plant, it is the only alternative among those selected for further evaluation that can be expected to have impacts significantly different from those of the 201's Selected Project. This alternative was developed using the same design flows as the 201's Selected Project, so that it would be directly comparable to that alternative. Consequently, it is not as easily compared to Alternatives II-B and III-B, whose interceptors, force mains, and extraneous flow holding basins are not oversized to the same degree. See Chapter III, Part D, Section 1(c) for a description of its major components.

a. Ernie Miller Park. The impacts caused to the park by building the Alternative to Expand the Harold Street Plant would be identical to those of the 201's Selected Project, since the same size interceptor would be built on the same alignment.

b. Population Growth and Land Use Changes. Approximately 160 acres would be temporarily disturbed during construction of this alternative. This includes a ten-acre allowance for expanding the Harold Street plant and 130 acres within the corridors of the gravity interceptors. Approximately 40 acres of this land would be permanently impacted. The force mains along 119th Street and Prairie Center Road would be within existing rights-of-way, so no major land use conversions would occur along these routes. The effects on land along the interceptor routes would be the same as those of the 201's Selected Project. The additions to the Harold Street plant would be on land that is currently an abandoned landfill. Since there would be only a lift station and extraneous flow basin at the confluence of Cedar and Little Cedar Creeks, less land would be converted there. There would be no direct impacts on the size or distribution of the local population because it would not be necessary to relocate existing dwelling units for right-of-way acquisition. The secondary impacts of this alternative, including the benefits of orderly growth resulting from staging the project, and the minor adverse effects of the interceptors having excess capacity and of not serving the area north of Olathe Lake in the Upper Cedar Creek basin, would be identical to those of the 201's Selected Project.

c. Cultural Resources. Building the Alternative to Expand the Harold Street Plant would significantly reduce the possibilities of disrupting archaeological sites, compared to building the 201's Selected Project, since there would be no pipeline along Upper Cedar Creek, and only a lift station and extraneous flow holding basin at the confluence of Upper and Little Cedar Creeks, instead of a treatment plant. This is considered only a minor advantage, however, because of the relative ease of avoiding the sites.

d. Need for Other Alternatives. Except for not serving the Upper Cedar Creek basin north of Olathe Lake, all work needed to accomplish the goals of the project is included in the Alternative to Expand the Howard Street Plant. This project eliminates the need to transfer Sewer Districts 13a and 7 to the Johnson County USD. It also would facilitate implementation of the region's long-range plans by allowing time for development to occur north of the study area, so that, by the end of the design period, the plans to serve both the Cedar and Mill Creek basins with large plants downstream could possibly proceed without the need for interim plants.

e. Erosion, Siltation, Flood Damage, and Sludge Disposal. Although the greater length of pipeline trench required by this alternative would increase the amount of soil eroded, compared to that of the 201's Selected Project, the total would still be small. Siltation would probably be reduced, because less of the total pipeline length would be in direct proximity to the creeks. The need to protect project components from flood damage would also be reduced, since there would be no treatment plant at Cedar and Little Cedar Creeks, and the Harold Street plant site already meets flood protection criteria. Sludge disposal operations would be facilitated by there being only one plant site; however, the trickling filter process assumed for the expansion alternative would generate slightly more sludge than would the oxidation ditch used by the 201's Selected Project.

f. Implementability. This alternative would encounter the same public opposition as the 201's Selected Project, because it serves the same area. Even though it does not require additional work to meet the project's goals, it is unlikely to receive State or Federal approval because of its high cost.

g. Olathe Lake. Impacts to Olathe Lake under the Alternative to Expand the Harold Street Plant would be the same as those of the 201's Selected Project.

h. Other Impacts Not Related to Major Issues. The major benefits of constructing the Alternative to Expand the Harold Street Plant, compared to building the 201's Selected Project, would come from reduced adverse impacts on water quality and on aquatic and terrestrial ecology. An additional 2.6 mgd of treated sewage would be discharged into Mill Creek. Impacts to Mill Creek would include an increase in the BOD, and an increase in the COD because of additional chlorine released. The increased total chlorine residuals would also most likely displace the aquatic fauna further downstream from the outfall, and would place additional stress on the biota of Mill Creek. While the water quality and diversity of aquatic fauna would be slightly decreased in Mill Creek, the direct adverse impacts on the aquatic ecology of Cedar Creek would be avoided entirely. Because Cedar Creek is in a more rural watershed, and presently receives an insignificant amount of sewage effluent (which would also be eliminated), it has a better environmental quality than does Mill Creek. Thus, from an ecological standpoint, Cedar Creek is the more valuable of the two streams, and protecting it from degradation by diverting sewage to an enlarged Harold Street plant would be the most favorable alternative.

Terrestrial ecology would benefit to a lesser degree. There would be no destruction of vegetation or wildlife habitat along Upper Cedar Creek north of Olathe Lake, since the force main proposed for that alignment would be routed along street rights-of-way to the Harold Street plant, instead. Also, the smaller acreage required at the confluence of Upper and Little Cedar Creeks would result in less damage than under the 201's Selected Alternative, while building on the abandoned landfill is not seen as disturbing the habitat of any desirable species.

One additional adverse impact of the Alternative to Expand the Harold Street Plant is that it is the most energy-intensive of all the projects considered in detail, since it involves pumping all the sewage generated in the Upper and Little Cedar Creek basins even further than would be the case under Alternative III-B. This aspect of the project could make it even more uneconomical during the design period, if energy costs continue to increase.

6. Summary of Impacts

Table 26 summarizes the principal impacts caused by the alternatives considered above. The alternative numbers given in the table correspond to the key, below:

1. 201's Selected Project
2. No-Action Alternative
3. Alternative III-B
4. Alternative II-B
5. Alternative to Expand the Harold Street Plant

TABLE 26
MAJOR IMPACTS SUMMARY

IMPACT CATEGORY	ALTERNATIVE	IMPACT DESCRIPTION
Terrestrial Ecology	1,3,4	46 acres permanently taken for plant sites & rights-of-way; another 102 acres disturbed temporarily by construction. 46 acres of forest removed, 7 of which are in Ernie Miller Park. Significant loss of trees on west side of Olathe Lake. Relatively minor loss of wildlife habitat. Severe loss of aesthetic values and utilization of Ernie Miller Park.
	2	No impact to Ernie Miller Park or west side of Olathe Lake. About 100 acres permanently taken for plant sites. Considerably greater amount of land needed for residential development.
	5	40 acres permanently taken for plant sites and rights-of-way; another 120 acres disturbed temporarily by construction. 36 acres of forest removed. Impacts on Ernie Miller Park and west side of Olathe Lake same as for Alts. 1, 3, & 4.
Water Quality	1,3,4	Up to 3 mgd treated effluent discharged to Cedar Creek, causing increased BOD and SS loads, a major impact, but within stream standards. No significant improvement of Mill Creek. Temporary, minor turbidity and siltation increases in creeks during construction; probable major turbidity and siltation problems at Olathe Lake.
	2	Almost same total discharge, but from numerous points. Higher SS concentrations from lagoons. No improvement of Mill Creek. Slightly higher temporary turbidity and siltation in creeks, but still minor. No construction impact (siltation) on west side of Olathe Lake, but slightly increased eutrophication rate from discharging lagoons, etc., upstream.

TABLE 26
MAJOR IMPACTS SUMMARY (Continued)

IMPACT CATEGORY	ALTERNATIVE	IMPACT DESCRIPTION
	5	No discharges to Cedar Creek. Up to 3 mgd additional treated effluent discharged to Mill Creek, causing slight additional deterioration of presently poor quality. Slightly higher temporary turbidity and siltation in creeks, but still deemed minor. Same impacts on Olathe Lake as Alts. 1, 3, & 4.
Aquatic Ecology	1,3,4	Significant reduction of diversity and density of benthic organisms, and displacement of sensitive mobile species in Cedar Creek, due to reduced oxygen and sunlight and increased chlorine. No improvement in Mill Creek.
	2	Impacts similar to above, but more serious near lagoon outfalls because of increased SS concentrations. Slightly less displacement because smaller individual discharges are more quickly assimilated.
	5	Only temporary turbidity and siltation impacts in Cedar Creek; slight additional reduction in species density and diversity, and further displacement of sensitive mobile species, in Mill Creek.
Population Growth and Land Use Changes	All	No relocation required. Study area population in year 2000 same for all alternatives, since other factors will control choice of homesite. Land retired for project components negligible.
	1,5	Have excessive capacity in interceptors, a slight incentive for development beyond projections. Will not serve Upper Cedar basin north of Olathe Lake, a minor disadvantage because of lack of readily-developable land.

TABLE 26
MAJOR IMPACTS SUMMARY (Continued)

IMPACT CATEGORY	ALTERNATIVE	IMPACT DESCRIPTION
	2	Will cause low-density, "leapfrog" development pattern, requiring considerably more land for housing, and inhibiting efficient provision of other community services. Will cause growth to lag initially, with rapid influx after 1990.
	3	Will not serve Upper Cedar basin north of Olathe Lake, Little Cedar basin north of City Limits, or Persimmon Hills area, causing extremely high densities in southern part of Little Cedar basin and rapid, early development south of Olathe Lake; deemed a major adverse impact.
	4	Best choice for constant, orderly growth of entire study area.
Cost-Effectiveness		Alternative 3 is most cost-effective, with Alternative 4 close behind. Alternative 5 is least cost-effective.
Local User Costs	All	None of the alternatives would place a significant financial burden on the community in general. Any of them, however, may involve hardship for lower- and fixed-income residents.
Threatened or Endangered Species	All	There should be no impacts on threatened or endangered species or their habitat.
Cultural Resources	1,3,4	High likelihood of disturbing archeological sites, a major impact, but easily avoided.
	2,5	Considerably less likelihood of disturbing archaeological sites.

TABLE 26
MAJOR IMPACTS SUMMARY (Continued)

IMPACT CATEGORY	ALTERNATIVE	IMPACT DESCRIPTION
Achievement of Objectives	1	Does not serve Upper Cedar Creek north of Olathe Lake; requires additional work to remove Sewer Districts 13a and 7 from Harold Street plant, and to replace equipment at Harold Street plant for plant to remain adequate.
	2	Would require development and implementation of entirely new approach to study area's problems, causing significant additional delay.
	3	Does not serve Upper Cedar Creek basin north of Olathe Lake, Little Cedar Creek basin north of City Limits, or Persimmon Hills area; requires same additional work as Alternative 1 for Harold Street plant to remain adequate.
	4	Serves entire study area, but requires same additional work as Alternatives 1 and 3 for Harold Street plant to remain adequate.
	5	Same as for Alternative 1, except only replacement of existing equipment would be needed to keep Harold Street plant adequate.
Implementability	1,5	Considerable public opposition expected; also delays at State and Federal levels because of high cost.
	2	No public opposition expected, but considerable delay in formulating program and getting State approval, since approach violates State policy.
	3	Reduced public opposition, since less unincorporated area served. Delay expected at State level, since Persimmon Hills area not served, as previously requested by State.

TABLE 26
MAJOR IMPACTS SUMMARY (Continued)

IMPACT CATEGORY	ALTERNATIVE	IMPACT DESCRIPTION
	4	Same public opposition as Alternatives 1 and 5; probably most acceptable alternative to both State and Federal agencies because of low cost and complete coverage of service area.
	All	Require considerable coordination with County, which has not yet commenced.

CHAPTER V POTENTIAL MITIGATIVE MEASURES, REQUIREMENTS, AND RECOMMENDATIONS

There are a number of courses of action that could be taken to reduce or avoid the adverse impacts associated with building and operating the 201's Selected Project. Parts A and B of this Chapter discuss measures available to mitigate impacts on the natural and man-made environments, respectively. In Part C, those measures that are deemed necessary and/or cost-effective, and which EPA has the legal authority to enforce, are listed as requirements that EPA intends to make conditions of further grant funding for the project. Other desirable mitigative measures, which are either not economical, or are beyond EPA's jurisdiction to enforce, are listed as recommendations for consideration by local authorities.

A. MITIGATION OF IMPACTS ON THE NATURAL ENVIRONMENT

1. Air Quality

Dust may be a problem during construction, since the particulate levels in the study area are already quite high. Construction areas should be sprinkled during dry periods to reduce dust. Exhaust emissions from construction equipment could be minimized by thorough equipment maintenance.

2. Noise

The proposed treatment plant is in an undeveloped area, and will initially need no noise controls. However, operating noise could become annoying to any new residential developments close to the site. Measures should be taken to ensure that no development occurs within audible limits or to make noise controls part of the plant's design criteria.

Construction equipment should be equipped with adequate mufflers, especially when working in developed areas. Construction activities in developed areas should be limited to daylight hours. Blasting should also be limited to daylight hours, regardless of location, and should be preceeded by an intensive public information campaign to warn residents when to expect it.

3. Odor

Offensive odors normally are not a problem at properly-run oxidation-ditch treatment plants. However, odors might become a problem if sludge is drawn to the drying beds before stabilization, or if raw sewage becomes septic before reaching the treatment plant. Therefore, development close to the treatment plant should be discouraged.

4. Topography, Soils, and Geology

To mitigate impacts on topography, a site grading plan should be formulated that will minimize disturbance of the area. The plan should also provide for proper drainage, replacement of vegetation, and other corrective measures. Spoil piles within the construction area that are to be permanent should be graded to drain, and planted to blend with the site's topographic appearance.

Several mitigative measures are available to reduce the impacts to soils. Removal and temporary stockpiling of topsoil should be required, so that it can be distributed over disturbed areas upon completion of construction. There is no reasonable and economic mitigative measure available to prevent subsoil disturbance. Excavated areas should be kept to a minimum, and compaction of all backfill should be required to reduce settlement. Exposure of raw soils should be minimized to prevent erosion, the accompanying turbidity and siltation of streams, and the generation of airborne dust. Steep slopes should be graded and mulched immediately, or otherwise protected against slope failure and erosion by such measures as terracing, stabilizing with soil-cement mixtures, or covering with concrete slope walls or rock rip-rap. Sodding or other special plantings may also be used. Deep excavations in poor subsoil should be shored to minimize disturbance and provide safe working conditions. Temporary storm-water retention basins should be provided at the treatment plant site to detain peak runoff and to prevent stream siltation and turbidity.

Blasting requires emphasis on safety precautions. Rock not used for backfilling could be used for erosion protection, spoiled in such a manner as to blend with the surroundings, or hauled away for disposal at an approved site.

The particularly severe erosion problem likely to be caused by constructing a gravity interceptor along the steep west shore of Olathe Lake can best be mitigated by avoiding that area entirely. To function as a gravity conduit serving areas south of the lake, the pipe would have to be below the lake's surface. This would make service connections to the homes atop the 40-50 foot high bluff practically impossible to construct, thus negating the only logical reason for building on that alignment. To avoid these impacts, the major lift station proposed to be built at the north end of the lake should be built on the south end, along Dennis Avenue, instead. A shallow force main could then be run along the top of the bluffs on either side of the lake, causing minimum disturbance to soils, vegetation, and the lake. The homes on the west side of the lake could then be served by a small pressure system that discharged to the major lift station's wet well.

Another possibility would be to construct the proposed gravity interceptor around the east side of the lake, where the bluffs are not so high, and where the golf course offers ample room to locate the sewer away from the shore. This would also be a slightly shorter route. The homes on the west side of the lake could then be served by a pressure system pumping north to the major lift station's wet well.

In the case of Facilities Plan Alternative II-B, which proposes a gravity interceptor the entire length of Upper Cedar Creek, the lift station on the south end of the lake and the pressure system serving the homes on the west side of the lake could pump to a continuation of the gravity line beginning north of the dam. Alternately, the gravity interceptor could be designed to avoid the lake by tunneling a short distance west along Dennis Avenue to reach the watershed of a small tributary that joins Upper Cedar Creek just below the dam. The gravity line could then continue north, well west of the lake. This possibility, however, would be much more expensive, and would still present difficulties in serving the residences along the west side of the lake.

Constructing the major lift station on the south end of the lake would, of course, increase its operating and maintenance costs because of the greater distance and higher elevations it would have to operate against. This would, however, be largely balanced by the savings in the capital costs from building a force main instead of that section of gravity interceptor.

5. Terrestrial Ecology

a. General Mitigation. The generally north-south alignments of the proposed pipelines and the narrow permanent rights-of-way, combined with the overstory of surrounding vegetation, would effectively prevent establishment of herbaceous plantings in wooded areas because of lack of sunlight. Allowing growth of native forbs and other invader vegetation would provide more benefit than continued attempts to establish other vegetation types. Pasture, lawn, and other unforested disturbed areas should be reseeded with appropriate vegetation as soon as possible.

The prevention of woody growth necessary to maintain access to the pipelines should be accomplished through a restrictive mowing program. Broadcast application of brush control chemicals should be prohibited. If additional control is necessary, hand cutting should be used. Mowing the rights-of-way should be restricted to dates least detrimental to wildlife. Mowing should not be performed until after July 1 each year, to aid natural reproduction of wildlife using these areas.

b. Ernie Miller Park. Several possibilities exist for reducing or avoiding the significant damage to the aesthetics and utility of

Ernie Miller Park that would be caused by constructing a pipeline through it. These possibilities include restoration, tunneling, pumping around the park, and replacement of the park.

1) Restoration. A tentative easement agreement, proposed to be executed by the City and the Johnson County Parks and Recreation Department (see Appendix A-4), includes extensive protective and restorative measures to be taken to minimize the adverse impacts of constructing the proposed interceptor through the park. The major items of work involved are listed below:

a) Make an inventory of all existing trees larger than 2 inches in diameter within the proposed construction easement.

b) Record existing topsoil depths and develop accurate topographic mapping.

c) Design the sewer alignment to avoid removing trees. Make every effort to preserve and protect all existing trees. Fence trees to remain, or wrap their trunks with protective coverings. Fence the entire construction easement boundary to prevent accidental encroachment of construction equipment onto other park property.

d) Strip all topsoil and stockpile it on relatively flat ground, and grade so as to prevent excess loss from erosion.

e) Develop final grading plans to reflect the original contours. Set manhole rim elevations in areas outside of the 100-year flood limits flush with the finished surrounding grade, so as to not create any visual obstructions.

f) Redistribute stockpiled topsoil over all disturbed areas.

g) Use the original inventory of existing trees to develop a planting plan that creates natural-appearing open spaces, tree masses, and understory masses, and which eliminates the corridor effect. The planting plan should include those trees identified in the inventory in the same number and percentage mixture of species as originally existed. Shrubs may be incorporated into the plan as an alternative to replacement trees at a 2:1 ratio; that is, if four replacement trees are called for, eight shrubs would be substituted. Tree sizes should be mixed to create a natural appearance. Natural-appearing open spaces, or meadows, comprising about 20 percent of the construction easement area, should be created at varying distances to prevent the corridor effect. These open spaces should be planted with native grasses and forbes, and designed to augment the natural area park usage by providing opportunities for studying natural plant succession. All other areas disturbed by construction operations should be seeded with native grasses and forbs. To provide access to the sewer, spaces no wider than 15 feet between trees should be maintained throughout the easement. This access should vary in width, tie into the open spaces, and meander sufficiently to not create a corridor effect. The planting plan should be designed by a licensed landscape architect, in consultation with the Johnson County Park and Recreation District, and carried out utilizing the best horticulture methods.

h) Following planting operations, immediately seed, fertilize, mulch, and water, using an approved mixture of native grasses and forbs. Cover any area of 4H:1V or steeper slope with an erosion-control netting or matting to hold the seed, fertilizer and mulch in place.

i) Immediately repair any trees designated to be preserved that are damaged during construction or revegetation operations, using the services of a licensed arborist.

The total present worth of this restorative and protective work has been estimated by various landscape architects to range from $130,000 to $307,000 (1979 dollars). These costs would be in addition to the previously-discussed costs of the project. The lower of the estimates does not include costs associated with maintaining the restoration work (guarantees, reseeding, replacing failed plantings, etc.); administrative, engineering and legal fees; or interest during construction. Both estimates fail to include the cost of approximately eight feet of additional rock excavation that would be required for the currently-proposed alignment along the old railroad bed, since they deal only with restorative and protective measures. However, the costs presented earlier for constructing the interceptor were based on an alignment following the creek, and were not increased when the proposed alignment was changed to take advantage of the lower density tree cover along the railroad bed. Both estimates also omit the cost of the 7.5 acres of replacement land that HCRS can require as a condition of allowing construction.

2) Tunneling. The Facilities Plan suggests the possibility of constructing the interceptor through the park by tunneling, rather than the usual open-cut method, at an estimated 1979 present worth of $693,000. This compares to an estimated $161,000 for open-cut construction on the original alignment along the creek. Tunneling would greatly reduce the impacts to the park, since it would require construction activities in the park only at about seven points of turning along the 2,900-foot length of the sewer. The work at these seven points could be easily limited to small areas, and access could be provided without extensive damage to the park. Most importantly, the corridor effect resulting from deforestation along the sewer route would be eliminated entirely. There is some concern, however, that the cost estimate for this option may prove to be low, because of the extensive fractured limestone and the high water table likely to be encountered throughout the park.

3) Pumping Around the Park. Impacts to the park could be avoided entirely by building a major lift station and an extraneous flow basin immediately south of the park, and pumping around the park to a continuation of the gravity interceptor north of the park. The force main could be built east of the park, along Highway K-7, or west of the park, through the City landfill. If the western route is selected, about two acres of upland forest and six acres of rangeland would be affected. The eastern route would, due to its existing altered condition, disturb acreage that is occupied mostly by weed species. In both instances, the disturbance to local wildlife would be minimal. The erosion from trenching would be less severe along the western side of the park, where vegetation would tend

to moderate run-off. In either case, the construction could result in a slight increase in turbidity of Little Cedar Creek. The instability of the landfill would require special bedding measures, and the pumping costs would be greater for the western route because a higher elevation would have to be overcome. Considering the impacts of both routes, the corridor east of Ernie Miller would be preferred.

The Facilities Plan estimates the total present worth, including O&M, of the eastern route to be $567,000. The western route, which is considerably shorter, would have a total present worth of about $514,000, in spite of higher O&M costs, according to EPA estimates.

4) Replacement of the Park. Because of the proximity of Highway K-7 and the City landfill, it has been argued that the value of the park as a wilderness area is already severly compromised, and will be even further degraded by litter, unauthorized usages, vandalism, etc., as urban development of the area continues. This is seen as resulting in the park being surrounded by residential subdivisions and commercial establishments before the end of the design period, and being converted to active uses (playgrounds, athletic fields, swimming pools, etc.) more in keeping with its new surroundings.

Proponents of this line of reasoning suggest that the City should purchase a comparable park, slightly farther away from presently-developed areas, but still convenient to present users, and trade it for Ernie Miller Park. This would then allow construction of the interceptor without interference from HCRS or the State, and would provide the City with a large area to develop for active recreational uses, as needed, in the heart of its rapidly-developing west side.

While there is considerable merit to this line of reasoning, it is by no means certain that the predicted degradation of the park will occur. Further, such a project would be time-consuming and expensive. The cost of the land alone would probably be on the order of $250,000, depending upon its location, and there are no assurances that a suitably-sized tract with the requisite woodlands and proximity to the City would be readily available. The City would probably also be obligated to pay development costs at both parks, as well as the cost of constructing the sewer. Perhaps the primary fault of this approach, however, is that it would foreclose the option of preserving Ernie Miller Park as a wilderness area. Once the sewer is built, with no mitigation, the above scenario would become a self-fulfilling prophecy.

c. Olathe Lake. The mitigating measures to prevent erosion on the west side of Olathe Lake discussed in Section 4, above, would also preserve the trees and wildlife habitat at that location that would be severely damaged by the proposed construction.

6. Water Quality and Hydrology

To comply with Executive Order No. 11988 (May, 1977; 40 CFR, Part 6, Sections 3-7), EPA requires that facilities built in floodplains be protected against damage by the 100-year flood, and that they must be fully operable during the 25-year flood. To meet these requirements, plant facilities would preferably be located outside the floodplain. Extraneous flow holding basins, which would have to be located in the floodplain, should be designed with embankment protection, and embankments must extend above the 100-year flood elevation. Manholes in floodplains should be made watertight, and special care should be taken to ensure that sewer joints are also as tight as possible. This may require more restrictive infiltration/exfiltration specifications than are normally employed in the area, but the reduction of infiltration would prevent overloading the plant, and would also prevent lowering the groundwater table along the interceptors. To further comply with the President's Executive Order, both the City and the County should adopt ordinances prohibiting sewer connections to residences or businesses located within the 100-year floodplains of the two creeks. Such ordinances would effectively eliminate development in hazardous areas, and would not cause severe hardship to property owners, because of the relatively narrow floodplains exhibited by the creeks.

The only mitigative measures that would significantly reduce the adverse impacts on the water quality of Cedar Creek caused by the treatment plant discharge would be to provide some form of additional treatment to further lower the BOD_5 and SS concentrations released, or to completely remove the discharge by selecting the alternative to expand the Harold Street plant. None of these approaches would be cost-effective, and, since the proposed plant would meet the State and Federal effluent requirements, and would not cause a reduction of quality below that required by the state's stream standards, none could be legally required or enforced.

The erosion prevention measures suggested in Section 4, above, especially those for the west side of Olathe Lake, would help mitigate the impacts of siltation and turbidity during construction.

7. Aquatic Ecology

Existing secondary waste treatment technology does not approach the stage of complete sewage purification. Although chlorination is presently the cheapest and most effective way to disinfect sewage, it is extremely toxic to aquatic life, even in very low concentrations. To minimize effects on fish and benthos, it would be desirable to provide dechlorination. Chlorinated effluent could be held in a lagoon before discharge to the receiving stream. This would also further reduce and oxidize detergents and ammonia. Alternately, other methods of disinfection, such as ozonation or ultraviolet radiation, could be used. All of these measures are relatively expensive, however, and could not be justified on a cost-effective basis, given the present stream standards.

Different types of outfall structures exhibit different rates and patterns of effluent mixing in the receiving stream. An outfall with multiple outlets across a stream produces a quick mixing of effluent, and forms a zone of concentrated sewage across a stream. This causes fish depletion, and a barrier that adversely affects fish movement. In contrast, effluent released from a stream bank takes a longer time and a greater stream length before completely mixing, but leaves an open pathway for fish movement on the opposite side of the stream. From the viewpoint of fish protection, the more primitive bank outfall is more effective than the multiple outlet, even though the effects of its higher concentration of pollutants are more severe on organisms in the plume path.

Long-term depressed dissolved oxygen levels can adversely affect both fish and the aquatic insects and other animals upon which fish feed. Aeration of the effluent to ensure a minimum dissolved oxygen concentration would benefit the aquatic life below the outfall.

Pipeline stream crossings should not be constructed during the spring. Breeding sites of fish species are often not where adult fish live, and many species move from pools to riffles, or far upstream into shallower headwaters, similar to the habitats found in Little Cedar and Cedar Creeks. Construction methods should be chosen that will minimize introduction of silt and sediment to streams. Pipeline construction should cross streams at right angles, and the crossing points should be at places with the narrowest width and/or shallowest banks. Stream bank protection measures should suit the stream, and erosion control should be used where appropriate. The original stream width should be maintained, and a 2:1 (horizontal to vertical) bank slope should not be exceeded.

B. MITIGATION OF IMPACTS ON THE MAN-MADE ENVIRONMENT

1. Population Growth and Land Use Changes

Direct conversion of the use of 7.5 acres of woodlands in Ernie Miller Park could be avoided by pumping around the park, or by implementing one of the other measures discussed in Part A, Section 5, above. Similarly, the temporary use conversion of agricultural lands could be reduced by timing the construction of the portions of the interceptors that pass through such lands to occur during the late fall or winter, so as to miss the planting, growing, and harvest periods.

The possibility of the project providing an incentive for population or industrial growth beyond that projected could be eliminated by redesigning the interceptors, extraneous flow holding basins, and force main to remove the excess capacity currently included. This would also result in a reduction in the project costs. However, that reduction might be offset by the costs of constructing parallel facilities at some time beyond the design period, should they ever be needed.

The pattern of residential development afforded by the 201's Selected Project could be improved slightly by choosing Facilities Plan Alternative II-B, instead, since it also serves the northern part of the Upper Cedar Creek basin. This would also slightly reduce the amount of prime farmland retired for residential development, since less of the land that could be developed in the northern part of the Upper Cedar Creek basin is in that classification.

Perhaps the most important measures that could be taken to ensure that the projected growth does not become unmanageable would be for the County to develop and promulgate its new zoning ordinance and comprehensive plan as soon as possible. These tools would enable the County to plan for, and adequately control, development in the unincorporated parts of the study area. They could also be very valuable in protecting forests and prime agricultural land from haphazard development. Another measure that would help avoid conversion of farmland to residential uses would be to adopt a policy of not assessing the costs of the project against such property until it is connected to the system. This would prevent the economic pressures on land owners that could be caused by blanket assessments on an acreage or front-footage basis.

2. Water Supply

The measures discussed in Part A, Section 4, above, for preventing erosion on the west side of Olathe Lake would also prevent any adverse impacts of the project on the area's water supplies.

3. Mitigation of Other Impacts Through Planning

a. Archaeological Resources. The cost of extensive site testing and complete excavation required to salvage the 15 archaeological sites most threatened by the project has been estimated to be $62,600, and could require several years to complete. Therefore, whenever possible, interceptors, force mains, and the treatment plant should be located so as to avoid archaeological sites. Special care will need to be taken in the vicinity of site 14J0505 and immediately south of the confluence of Cedar and Little Cedar Creeks. Any archaeological site that cannot be preserved should be properly tested to determine its significance, and salvage excavated, if necessary. The four potential *National Register* sites in construction corridors and two other sites immediately south of the confluence of Cedar and Little Cedar Creeks would be in particular need of salvage excavation, if they cannot be avoided. Exact site locations are being kept confidential to protect the resources, but will be provided to the City's designers.

Trenching within the creek valleys should be monitored on a selected sample basis by someone trained to recognize archaeological artifacts. Areas selected for monitoring should include those in the vicinity of identified sites. To protect cultural resources from heavy machinery, which scars the ground surface, construction equipment should be restricted to actual construction zones or ground free of archaeological sites. In instances of close proximity, fencing should be installed to delineate site boundaries.

The treatment plant should not be sited in the area between Cedar and Little Cedar Creeks south of their confluence because of the number of archaeological sites found in the area. If a decision is made to move the treatment plant or sewage lines north of the original planning area, care will need to be taken to avoid another site having potential for National Register status, site 14J0507.

b. Historical Resources. The southern portion of the proposed interceptor along Cedar Creek should be routed to avoid visible segments of the Sante Fe Trail. Care must also be taken to avoid disturbing the old Calamity Railroad bridge south of Little Cedar Creek in Section 21. Any future planning modifications should avoid direct impacts to historic structures and sites.

c. Economics. As discussed in Part B of Chapter IV, the interceptors, force main, and extraneous flow holding basins of the 201's Selected Project are designed for a much larger "ultimate development" population than is considered likely if present development trends continue. To justify constructing those facilities at this time requires the assumption that the "ultimate development" population would be reached during their 40-50 year useful life. This is extremely unlikely to occur, and it certainly will not happen during the design period. Therefore, the excess capacity proposed can only be regarded as a waste of financial resources. Further, since the capacity has been tentatively ruled ineligible for Federal grant funding, the entire burden of paying for it would be borne by the local population.

To avoid these impacts, the facilities should be redesigned for no more than the maximum flows allowed by EPA's eligibility guidelines. Short of this, a substantial reduction of the adverse economic impacts could be achieved by adopting Alternative II-B, which uses smaller pipes.

If the project's capital costs are assessed over the entire study area on an acreage or front-footage basis, as is commonly done, considerable economic pressure would be brought on owners of prime agricultural land to sell their land to developers. To avoid this impact, the assessment system should be established so that only connected properties are required to pay any part of the system's capital costs, and then only in proportion to population or number of dwelling units connected, rather than the lot size. An additional benefit of this approach is that it would reduce the amount of public opposition to the project, thus improving its chances for early implementation.

The adverse impact caused by not including all the work necessary to achieve the project's stated goals is easily remedied.

The condition of the Harold Street plant should be assessed to determine which components will need to be replaced during the design period, and when. Accurate costs estimates should be made for this work, as well as for the work needed to transfer the flows from Sewer Districts 7 and 13a and to perform any needed sewer system rehabilitation. These costs should then be added to those of the 201's Selected Project, and a revised grant application submitted. Whether the additional work is ruled grant eligible or not, the revised cost estimates will provide City officials with information needed for planning and budgeting, and will also give the public a more accurate picture of the proposed project.

d. Wastewater Management Programs. Including the omitted work elements in the project, as discussed above, will ensure that the Harold Street plant will remain adequate throughout the design period, as intended. This, in turn, will avoid the adverse impacts on the City's wastewater management programs that would be caused by having to undertake additional, unanticipated work within the design period to maintain that adequacy.

e. Implementability. Several things could be done to improve the project's chances of being implemented without additional delay.

1) The interceptors, force main, and extraneous flow basins should be redesigned to comply with EPA's eligibility guidelines. This would remove possible State and Federal objections to the project's lack of cost-effectiveness. Adopting Alternative II-B, rather than the 201's Selected Project might also achieve this result.

2) The study area boundary could be redrawn to exclude the northern part of Upper Cedar Creek basin, which would not be served by the 201's Selected Project. This would serve to allay the fears of the residents of that area that they may be forced to annex to the City and help pay for the project. Since some of the most adamant objectors reside in this area, this could reduce opposition to the project significantly.

3) The omitted work elements necessary to keep the Harold Street plant adequate throughout the design period should be included in the project, as discussed in Item c, above. This would remove State and Federal concern that the project, as proposed, would probably not meet its intended objectives.

4) The City and County governments should immediately begin negotiations to resolve the questions concerning the manner in which service will be provided to residents of unincorporated areas and how the system's capital costs will be assessed. Such negotiations would preferably include considerable opportunity for residents of the study area to express their views. Ideally, from the standpoint of eliminating opposition to the project, an agreement would be reached under which the County would form sewer benefit districts, as needed, in the unincorporated areas, and contract with the City for treatment at the new plant. The agreement would also stipulate that the City would forego involuntary annexations in the study area during the design period, and that no costs would be assessed by either the City or County against any property until it was connected to the system.

Such an agreement would allow extension of service to those desiring it, and would not prohibit either the City or the County from requiring problem areas under their respective jurisdictions to connect to the system. It would, however, remove much of the concern expressed regarding involuntary annexation and taxation for services not received. It would also facilitate implementation of the long-range plans for the area, which envision eventual County control over all wastewater collection and treatment, by having the County already in control of most of the Upper and Little Cedar Creek basin collection facilities when the long-range plans are implemented.

Even though it is not considered likely that an ideal agreement would be reached, some concrete arrangement should be speedily established, if litigation and other delays are to be avoided. Whatever procedures are agreed upon should be given the maximum amount of publicity possible, so that the public will be fully aware of what will be done, and misunderstandings can be avoided. The publicity program should include full local newspaper and radio coverage, and at least one well-advertised public information meeting should be held to answer questions about the procedures.

C. REQUIREMENTS AND RECOMMENDATIONS

As stated in 40 CFR, Part 35, subpart E, Section 35.901, "The primary purpose of Federal grant assistance available under this subpart is to assist municipalities in meeting enforceable requirements of the Act, particularly, applicable national pollution discharge elimination system (NPDES) permit requirements." Further, Section 35.917(b) states, "Facilities planning will demonstrate the need for the proposed facilities. Through a systematic evaluation of feasible alternatives, it will also demonstrate that the selected alternative is cost-effective, i.e., is the most economical means of meeting established effluent and water quality goals while recognizing environmental and social considerations." Essentially, these and other regulations and guidelines promulgated pursuant to the Clean Water Act of 1977 (P.L. 95-217) conform to the Act's intent that the construction grants program be used to assist municipalities in cleaning up existing pollution problems, while allowing funding for adequate reserve capacity needed to meet growth during the planning period.

The investigations conducted for this EIS have found that the 201's Selected Project, as proposed, is not cost-effective, will not enable the City to meet "enforceable requirements of the Act" throughout the design period, and proposes to construct interceptors, a force main, and extraneous flow holding basins that have reserve capacity considerably in excess of that needed to meet growth anticipated during the design period. These shortcomings of the proposed project were found to have serious adverse impacts in the areas of economics, wastewater management program planning, and project implementability. Additionally, the 201's Selected Project will have serious adverse impacts on the terrestrial and aquatic ecology at Olathe Lake, Ernie

Miller Park, and the point of discharge in Cedar Creek. The requirements and recommendations listed below are the result of these findings.

1. Requirements

EPA intends to require, as conditions of further grant funding for this project, that:

a. The Facilities Plan, its Supplement, and the Steps 2 and 3 grant applications be amended to reflect that the project to be constructed is Facilities Plan Alternative II-B, and that the City will bear the entire cost of any interceptor, force main, or holding basin capacity exceeding that calculated in accordance with EPA capacity guidelines.

b. The amended Facilities Plan include, as part of the project, all additional work needed to ensure that adequate treatment levels will be maintained at the Harold Street plant throughout the design period. This will require including accurate cost estimates of any necessary equipment replacement at the plant; of any sewer system rehabilitation work necessary to reduce the plant's influent volume; and of all costs, including those of contracting with the Johnson County USD for treatment, involved in diverting the flows from Olathe Sewer Districts 13a and 7 to USD's Mill Creek plant.

c. The City adopt an ordinance prohibiting the extension of sewer service to any development constructed within the 100-year floodplain of either of the creeks.

d. Facilities Plan Alternative II-B be modified to incorporate a major lift station at the south end of Olathe Lake that pumps to a continuation of the gravity interceptor north of the dam.

e. Facilities Plan Alternative II-B be modified to incorporate a major lift station at the south end of Ernie Miller Park that pumps to a continuation of the gravity interceptor north of the park through a force main routed east of the park, along Highway K-7.

f. The routing of interceptors and the exact plant site selection be carefully coordinated with the State Historic Preservation Officer during Step 2 design, to avoid disrupting archaeological sites. Arrangements for any necessary salvage excavation of sites that cannot be avoided shall be made at the earliest possible date. A letter from the SHPO giving conditional approval of the project will be required before award of the Step 2 grant. A second letter, stating that the routings and sites meet his approval, and that necessary excavations are complete, will be required before award of the Step 3 grant.

g. The plans and specifications for the project include the normal construction impact mitigation provisions, especially those for: dust control by sprinkling during dry periods; advance public announcements of blasting operations; that blasting be conducted only during daylight hours; proper grading, topsoil handling, and prompt replacement of disturbed vegetation, in kind; adequate protection against flooding for all facilities built within the 100-year floodplain; stream-crossing alignments and procedures that will minimize turbidity during construction; restriction of the contractor's equipment to the construction easements approved by the SHPO near archaeological sites; adequate, functioning mufflers on all construction equipment used near developed areas; and that a qualified archaeologist, empowered to halt construction, be employed to accompany crews working near known archaeological sites.

2. Recommendations

EPA further strongly recommends that:

a. If the stream's width and currents allow, the plant's outfall be designed so that the mixing zone for at least one-half mile downstream occupy no more than one-half the width of the stream, thus providing unimpeded passage for fish and other mobile aquatic organisms.

b. A method be developed to recover the local capital costs that assesses only connected users, and that it not be based on acreage or front-foot charges, but follow, instead, EPA's user charges guidelines.

c. The City immediately initiate the negotiations with the County, complete with an attendant public information and involvement program, as described in Part B, Section 3.e.(4) of this Chapter.

CHAPTER VI PUBLIC PARTICIPATION AND COORDINATION

A. PUBLIC PARTICIPATION

The first major public involvement in the proposed project was at the formal public hearing on the Facilities Plan, on December 14, 1976, at the Olathe City Hall. A slide presentation was made that summarized the Facilities Plan and the Environmental Assessment. The meeting was then opened for questions. Six citizens asked numerous questions regarding odors, plant locations, noise, type of treatment plant to be built, what areas would receive service, how capital costs would be assessed, and whether or not the City intended to annex the study area. Few direct answers were received, as it was continually stressed that the City Commission had not had time to study the report, that the report was only a study, and that no decisions had been made regarding its recommendations. Neither support for, nor opposition to, the project was evidenced by any of the comments made at the hearing. However, as discussed in Chapter I, Part B, Section 1, the Johnson County Park and Recreation District filed formal written objections to part of the project on January 13, 1977. Also shortly after the hearing, 220 signatures were collected on a petition opposing "...the sewer proposal and also the potential annexation...."

No other public meetings were held specifically concerning the proposed project until January 10, 1979. In the interim, however, the public had actively interjected itself into the project by means of numerous letters to the editors of local papers, to EPA, and to the City Commission, and by attendance at City Commission meetings. Although sentiments were highly divided, the very amount of controversy generated was a factor in EPA's decision to prepare an EIS.

On Wednesday, January 10, 1979, EPA sponsored an informal public workshop concerning the proposed project and the EIS being prepared on it. The meeting was held at the Oregon Trail Junior High School, which is in the study area. Approximately 50 persons attended, including about 25 private citizens, and a like number of project-related local, State, and Federal personnel. The background of the Facilities Plan and the principal features of the proposed project were summarized, and the construction grants program and the EIS preparation process were explained. The meeting was then opened to questions from the audience. The discussion was lively, but orderly, with opinions expressed being nearly evenly divided for and against the project. Proponents cited traffic problems resulting from the lack of balanced growth; the hardship caused to developers, the City, and prospective home buyers by the moratorium on sewer extensions; the expense of temporary measures, such as the lagoons at Persimmon Hills, and the probable need for more such facilities in the near future; the need for commercial and industrial growth to balance residential growth; and the existing problems with overflowing lift stations, inadequate septic tanks, and overloading of the Harold Street plant as reasons for proceeding with the project. Opponents were primarily concerned with preventing urban expansion to rural areas, and raised questions of impacts on water quality downstream from the project area, objected to paying for sewers that would not benefit them, objected to the ruination of the presently unspoiled character of Cedar and Little Cedar Creeks, and expressed disbelief that any sizeable number of people would move to the study area without the inducement of sewerage facilities. The meeting lasted about 3 hours, and informal discussions continued for about 30 minutes after adjournment.

Each person who attended the workshop received a project information packet, which included a 5-page "public input questionnaire." Several additional packets were requested by opponents of the project for distribution to persons who could not attend the workshop. Subsequent to the meeting, 47 of the questionnaires were returned to EPA, 41 against the project, and 6 for the project. Three letters supporting the project, and one against, were also received, as were copies of the 1977 petition against the project and potential annexation that had been signed by 56 persons in 1979.

In addition to these organized meetings, EPA and the EIS preparers have actively maintained communications with area officials and residents throughout the EIS preparation process. EIS study team personnel have obtained information from several study area residents, and have investigated references provided by them. A toll-free line to EPA regional headquarters in Kansas City has been made available to the public for those wishing to contribute information to the EIS preparation effort.

The public participation program will continue with the formal hearing on the Draft EIS, which will be held approximately 30 days after publication of the notice of its availability.

B. COORDINATION

This EIS has been prepared in coordination with other Federal, State, and local agencies and private firms. A complete list of organizations contacted is given in Table 27, below. In addition to the agencies listed, numerous contacts were made with private citizens. LaVene Brenden, Kansas Department of Health and Environment; Terry McKanna, Utilities Director for the City of Olathe; Steve Phillips, of Black & Veatch, Consulting Engineers, the Facilities Plan preparers; Howard O'Connor, of the Kansas Geologic Survey; Lugene Ritter, of SCS; and Don Huggins, aquatic biologist for the State Biological Survey at Kansas University, were particularly helpful in providing information for this EIS.

TABLE 27

ORGANIZATIONS CONTACTED DURING THE EIS PROCESS

Federal Agencies

U.S. Army Corps of Engineers, Kansas City District
U.S. Department of Agriculture, Soils Conservation Service
U.S. Department of the Interior

Geological Survey
Heritage Conservation and Recreation Service, Denver
National Park Service

State of Kansas

- Biological Survey
- Bureau of Air Quality and Occupational Health
- Department of Health and Environment
- Department of Transportation
- Division of Water Resources
- Fish and Game Commission
- Geologic Survey
- Historical Society
  - State Historic Preservation Officer
  - State Archaeologist
- Park and Resources Authority
- School for the Deaf
- University Cooperative Extension Service

Regional Agencies

- Mid-America Regional Council

Johnson County

- Appraiser's Office
- Board of Commissioners
- Community College, Department of Business and Economics
- Community Development Office
- Conservation District
- Engineer's Office
- Fire Dispatcher
- Health Department
- Industrial Airport
- Park and Recreation District

- Register of Deeds Office
- Sheriff's Department
- Unified Sewer District

Local Agencies

- City of Olathe
  - Controller
  - Department of Community Development
  - Department of Parks and Recreation
  - Department of Public Works
  - Department of Utilities
  - Engineering Department
  - Fire Department
  - Police Department
  - Office of the City Manager
- Olathe Area Chamber of Commerce
- Olathe Community Hospital
- Olathe Memorial Cemetery
- Olathe Unified School District No. 233

Private & Semi-Public Concerns

- Black & Veatch, Consulting Engineers, Kansas City, MO.
- Century 21 Real Estate, Olathe, KS.
- Kansas Academy of Science, Lawrence, KS.
- Kansas City Power and Light Co.
- Kansas Power and Light Co.
- Kansas Ornithological Society, Newton, KS.
- Kansas Wildlife Federation, Wamego, KS.
- M.J. Hardin & Associates, Kansas City, MO.
- St. Louis and San Francisco Railroad, Kansas City, KS.
- Sante Fe Railroad, Dispatcher's Office, Emporia, KS.

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9. *Facilities (201) Planning Report for Olathe, Kansas*; Black & Veatch, Consulting Engineers; 1976.

10. Personal communications, Paul Urban, Johnson County Health Department, December 18 and 20, 1978.

11. Public input sheets; EPA Workshop, Olathe, Kansas; January 10, 1979.

12. *Geology and Groundwater Resources of Johnson County, Northeastern Kansas* - Howard G. O'Connor, State Geological Survey of Kansas, Bulletin 203, 1971.

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APPENDIX A

MISCELLANEOUS DOCUMENTS

Contents

A-1 Notice of Intent to Prepare an EIS

A-2 Map of Ernie Miller Park

A-3 Rules for the Use of Ernie Miller Park

A-4 Proposed Easement Agreement for Interceptor through Ernie Miller Park

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
1735 BALTIMORE
KANSAS CITY, MISSOURI 64108

OFFICE OF THE
REGIONAL ADMINISTRATOR

July 28, 1978

TO: All Interested Government Agencies and Public Groups

As required by guidelines for the preparation of Environmental Impact Statements (EIS's), attached is a Notice of Intent to prepare an EIS for the proposed Environmental Protection Agency (EPA) action described below:

City of Olathe, Johnson County, Kansas
Project No. C200751
Wastewater Facilities Study and Planning

If your organization needs additional information or wishes to participate in the preparation of the draft EIS, please advise this office at the above address. Attention: Edward C. Vest, Environmental Impact Statement Coordinator, INPR/EIST.

Sincerely yours,

Kathleen Q Camin

Kathleen Q. Camin, Ph.D.
Regional Administrator

Attachment

RECEIVED
SEP 20 1978
ENV SECTION

NOTICE OF INTENT

To Prepare an Environmental Impact Statement

U.S. Environmental Protection Agency
Region VII

PROJECT LOCATION - City of Olathe, Kansas

The study area consists of the entire Little Cedar Creek drainage basin and that portion of the Cedar Creek basin above the confluence of Cedar Creek and Little Cedar Creek. In addition, the study area includes that portion of the Mill Creek basin which lies within the present (1976) corporate limits of Olathe. Overall, the study area includes approximately 27,000 acres, comprising 3,600 acres in the Mill Creek watershed, 7,600 acres in the Little Cedar Creek watershed, and 15,800 acres in the Upper Cedar Creek watershed. Approximately 3,900 acres of the Little Cedar Creek and 16,000 acres of the Upper Cedar Creek watersheds lay within the City of Olathe.

PROPOSED EPA ACTION:

The selected plan consists of the construction of a new 1.5 million gallon per day (mgd) field-erected package-type treatment plant at a site on Little Cedar Creek at the north city limit of Olathe. The package plant would provide complete treatment of sanitary wastes by the two-stage activated sludge process and would include effluent chlorination. A package-type lift station and extraneous flow holding basins would also be provided. The plant would serve the anticipated population growth for the Upper and Little Cedar Creek drainage basins until approximately 1990.

The proposed plan also includes the immediate construction of a single interceptor sewer along Little Creek from a connection with the existing sanitary sewerage system at the K-7 Lift Station to the new package treatment plant, a single interceptor sewer along Cedar Creek from Cedar Lake to a lift station constructed at the city limit of Olathe west of Lake Olathe, a 12-inch force main from the lift station to the new field-erected package-type sewage treatment plant, and short connecting sewers required to connect the areas tributary to the Leaview Estates package plant and Younts, Prairie Center, and Provence Lift Stations to the proposed new interceptors.

ISSUES INVOLVED

The significant issues related to this project that will be addressed in the EIS are:

1. Potential physical and biological impact on Ernie Miller Park through which a main interceptor route is proposed. This 113-acre park is presently part of the Johnson County Park and Recreation District purchased, in part,

with Bureau of Outdoor Recreation funding. The park is designated as a natural area and contains 3 miles of nature study and hiking trails. Little Cedar Creek flows through Ernie Miller Park bisecting the woodlands in half. The proposed sewer would run adjacent to the creek, eliminating approximately 7 acres (approximately 7.5 percent) of the prime forest park area. There will be a loss of approximately 61 acres total of forest as the proposed sewer lines are installed.

2. Potential secondary impacts of growth and changes in land use are also major issues. Development in Johnson County has been rapid in recent years. The location of growth has been within the northeast section of the county. This area is gradually reaching its optimum density, however, and growth is expected to change course in a westerly and southerly direction; thus, making the study area vulnerable to an accelerated growth rate in the coming decade. Study area population was approximately 15,822 people in 1970, with approximately 95 percent of this figure within the city limits of Olathe. Overall projections in growth made by the Mid-America Regional Council Planning Agency indicate an increase from the 1970 figure of 15,822 to approximately 34,467 people in the year 2000. These increases in population cause heavy exploitation of land, air and water resources.

3. A real potential exists for the presence of archaeological and paleontological sites along the upper Cedar Creek and Little Cedar Creek basins in the study area. Forty-four archaelogical sites have thus far been recorded for an area along Cedar Creek from a point north of New Olathe Lake to the Kansas River.

4. Alternative routings need to be defined. In addition, detailed cost estimates, including mitigation costs of potential impacts resulting from feasible route alternatives need to be compared in detail. Included in the alternatives cost comparison should be the proposed expansion of the Harold Street Wastewater Treatment Facility upgrading. This plant currently discharges all wastewater above 2 mgd, yet is proposed to serve Upper Mill Creek basin during the design period of this project.

5. Primary impacts of soil erosion, sedimentation, and siltation resulting from construction runoff, particularly in the event an interceptor is routed through Ernie Miller Park, are potentially serious issues in this project.

The foregoing list of environmental issues represent only the major issues as seen from this stage of environmental impact evaluation. Additional issues, such as flood evaluation along the Cedar and Little Cedar Creeks and sludge disposal, also require analyses in this EIS.

ESTIMATED PROJECT COSTS

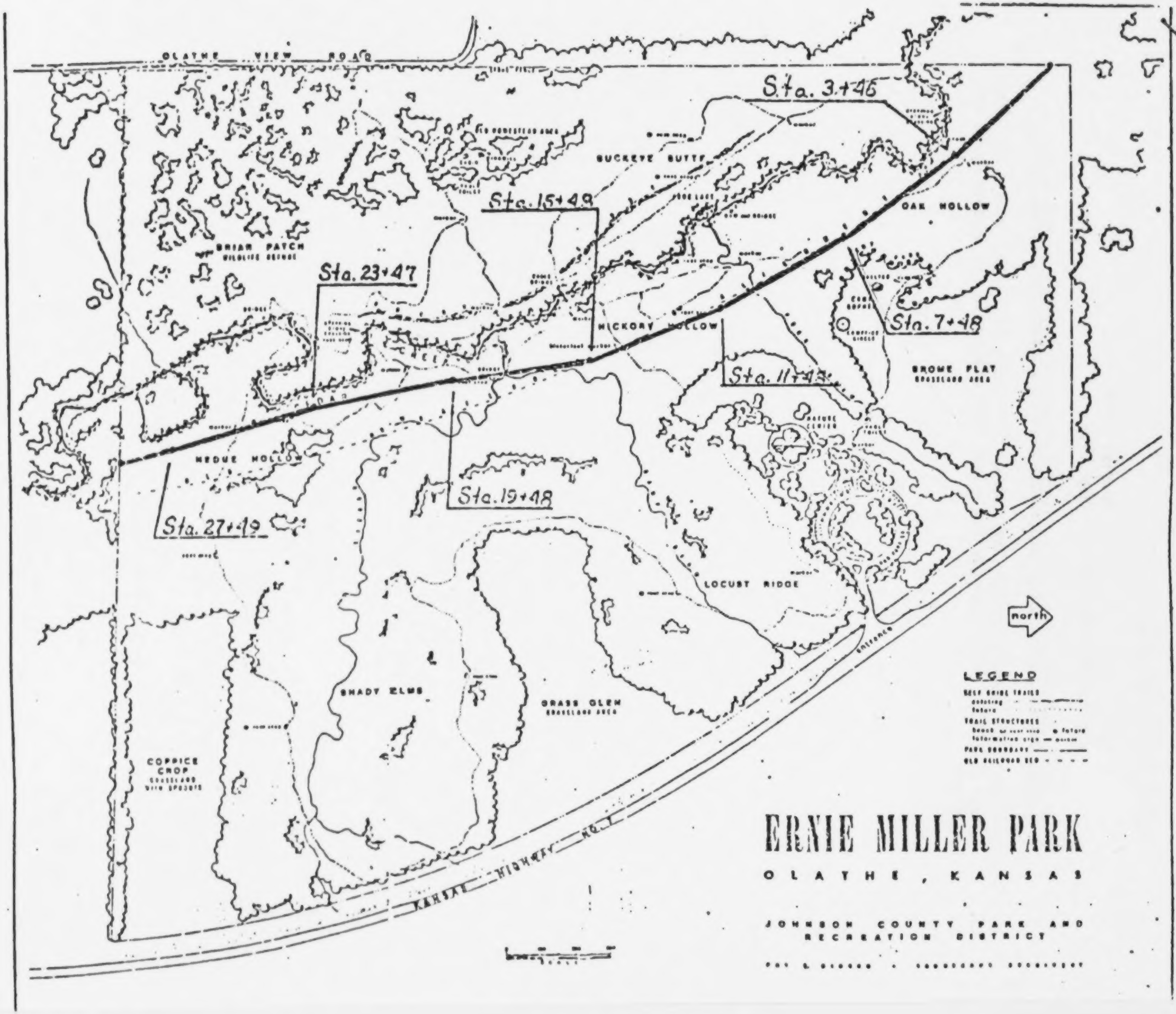
Federal Share:	$4,111,950
City of Olathe:	1,360,650
Total Cost:	5,472,600

PERIOD COVERED BY EIS

Start Date: August 1978
Approximate End Date: May 1979

CONTRACTED FOR TECHNICAL ASSISTANCE IN THE PREPARATION OF THE EIS:

Sverdrup and Parcel Associates, Inc., 800 North 12th Boulevard, St. Louis, Missouri 63101, will provide technical assistance in the preparation of this EIS.

OLATHE VIEW ROAD
Sta. 3+46
BUCKEYE BUTTE
OAK HOLLOW
Sta. 15+48
BRIAR PATCH
WILDLIFE REFUGE
Sta. 23+47
HICKORY HOLLOW
Sta. 7+48
BROME FLAT
GRASSLAND AREA
Sta. 11+43
HEDUE HOLLOW
Sta. 19+48
Sta. 27+19
LOCUST RIDGE
north
SHADY ELMS
GRASS GLEN
GRASSLAND AREA
COPPICE CROP
LEGEND
SELF GUIDE TRAILS
existing
future
TRAIL STRUCTURES
PARK BOUNDARY
OLD RAILROAD BED
entrance
KANSAS HIGHWAY NO. 7
ERNIE MILLER PARK
OLATHE, KANSAS
JOHNSON COUNTY PARK AND
RECREATION DISTRICT

RULES & REGULATIONS . . . ERNIE MILLER PARK

1. Camping for organizational groups only with sponsor or leadership supervision provided by the organization and group size not to exceed 40 persons.

2. Registration is required five days prior to use of camp site area.

3. All camping must be in Camp Gopher (District designated camping area).

4. Absolutely, no vehicular traffic inside park proper. All vehicles must be left in off-highway parking area at main entrance.

5. No pit latrines may be established. A vault toilet is available for use near the campground.

6. All campfires are to be built in the main campfire circle. All cooking fires are to be built at the established cooking sites. No auxiliary sites are to be established.

7. All firewood must be obtained from outside the park. No tree, living or dead, should be felled or limbs sawed off.

8. No nails, spikes or other permanent and/or destructive materials are to be used on any tree, living or dead, to secure ropes, lanterns or any other camping equipment. Ropes can be used to secure shelters. (Please, secure ropes only to the trunk of the tree).

9. Trash and garbage is to be carried out by the group and deposited in containers provided at the entrance. (Please, do not bury anything).

10. Expansion and/or modification of the campsite must be proposed in written form, including justification, prior to the event for review and clearance by the District's area manager or his appointed agent.

Questions concerning camp use, design, or regulations should be directed to the Reservation Clerk by calling 831-3355.

PLEASE, HELP US PRESERVE OUR PARKS!

JOHNSON COUNTY PARK & RECREATION DISTRICT
6501 Antioch Road
Shawnee Mission, Kansas 66202
Telephone: (913) 831-3355

(SEE SITE LOCATION MAP ON BACK)

UTILITY EASEMENT

THIS AGREEMENT, made and entered into this _______ day of ____________, 1977, by and between the Johnson County Park and Recreation District, a Corporation organized, incorporated and existing under and by virtue of the Laws of the State of Kansas, hereinafter called "Grantor", and the City of Olathe, a municipal corporation in the County of Johnson, State of Kansas, hereinafter called "Grantee".

WITNESSETH

WHEREAS, the Grantor owns and has title to a 113.69 acre tract of land in the northeast quarter of Section 27, Township 13 South, Range 23 East, lying southwesterly of Kansas Highway No. 7 and known as Ernie Miller Park; and

WHEREAS, the Grantee desires to obtain a permanent utility easement for the construction and maintenance of an interceptor sanitary sewer through said Ernie Miller Park.

NOW, THEREFORE, in consideration of One and no/100 Dollars ($1.00) in hand paid and other valuable consideration, receipt of which is hereby acknowledged, the Grantor does hereby grant and convey unto the Grantee, its successors and assigns, a permanent utility easement to lay, construct, alter, repair, replace and operate an interceptor sanitary sewer, together with the right of ingress and egress, over and through the following described premises in the County of Johnson, State of Kansas:

> A strip of land 25 feet wide thru the NE ¼ of Section 27, Township 13 South, Range 23 East in Johnson County, Kansas, lying 12.5 feet on each side of the following described centerline:
> Beginning at a point on the West line of the NE ¼ of Section 27 (bearing assumed to be South 0° 20' 30" West), 23.0 feet South of the NW corner of said NE ¼ Section; thence running South 40° 51' 05" East a distance of 381.58 feet; thence South 37° 20' 05" East a distance of 401.9 feet; thence South 29° 56' 05" East a distance of 399.7 feet; thence South 21° 03' 35" East a distance of 400.0 feet; thence South 7° 45' 05" East a distance of 400.0 feet; thence South 9° 37' 05" East a distance of 399.5 feet; thence South 15° 34' 05" East a distance of 402.3 feet; thence South 17° 00' 35" East a distance of 114.4 feet to a point on the South line of the NE¼ of Section 27 (bearing assumed to be South 89° 40' 25" East), 1,102.4 feet East of the SW corner of said NE ¼ Section.

The Grantor hereby further grants to the Grantee a temporary construction easement to expire two years after the acceptance by the Grantee of the interceptor sewer being built in conjunction with the above-described 25 foot permanent easement. Said temporary construction easement shall have a total width of 80 feet and shall lie outside of and adjacent to the above-described permanent easement. Said temporary construction easement shall lie either entirely on one side of the permanent easement or partially on each side. Prior to construction, the Parties hereto shall agree upon the location of such easement and shall file and record such location with the Johnson County Register of Deeds.

. THE PARTIES hereto agree that this grant is being made upon the following terms and conditions:

(1) That the Grantee shall make every effort in the design and construction of the said interceptor sanitary sewer to limit the removal of trees.

(2) That the Grantee shall inventory all existing vegetation within the permanent and temporary construction easement during the design of the interceptor sewer. All trees larger than two inch caliper will be identified, sized and mapped. They will be coded and marked in the field to be saved or removed.

(3) That the Grantee shall cause the construction contractor to install protective fencing along the temporary construction easement boundaries in order to protect the trees and forest floor outside the construction limits. These boundaries shall be indicated on the construction drawings and Plans.

(4) That the Grantee shall be required to have a licensed arborist repair any damage to existing tree trunks, branches or roots. Such repair shall be done according to professional aboricultural practices.

(5) That the Grantee shall not allow any construction fire to be set within 50 feet of any tree selected to be saved. Such fires shall be limited in size and be under constant surveillance.

(6) That the Grantee shall cause the construction contractor to collect and remove all trash, such as paper, plastic cups, cans, and bottles, at the end of each working day.

(7) That the Grantee shall not allow vehicular traffic upon the Park property, except along the agreed temporary construction easement.

(8) That the Grantee shall cause the contractor, upon completion of the construction operations, to:

(a) regrade all surface areas to their original contours.
(b) collect and remove all construction debris including rock, excess soil, lumber, cement, paper, cups, bottles, and all other trash.
(c) to reseed all surface areas stripped of the natural vegetation to a native grass mixture based on the initial survey of existing vegetation in the area.
(d) to plant native tree and shrub seedlings in irregular groups to hasten reforestation.
(e) to intentionally place natural looking open spaces along the permanent easement boundary in order to prevent a long, narrow corridor effect.

(9) That the Grantee shall construct all manholes flush with the surrounding grade to prevent them from being visual obstructions.

(10) That the Grantee shall require qualified landscape architects to develop all contract drawings and specifications for tree removal, protection, reforestations, an re-establishment of native grasses.

(11) That the Grantee shall consult with the Grantor during all design processes affecting the site restoration. Final drawings and specifications will be subject to its approval.

(12) That this agreement is binding upon the heirs, executors, administrators, successors and assigns, transferees and grantees of the parties hereto, and it is understood that this agreement cannot be changed in any way except in writing, signed by the Grantor and the duly authorized agent of the Grantee.

IN WITNESS WHEREOF, the parties hereto have set their hands and seals on this the_______________ day of__________________, 1977.

APPENDIX B

SPECIES LISTS AND OTHER BIOLOGICAL DATA

Contents

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B-1 Tree Genera and Number of Species Common to the Kansas City Metropolitan Region
B-2 Shrub and Vine Genera and Number of Species Common to the Kansas City Metropolitan Region
B-3 List of Mammals in the Kansas City Metropolitan Region
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TABLE B-1
TREE GENERA AND NUMBER OF SPECIES COMMON TO THE KANSAS CITY METROPOLITAN REGION

Common Name	Genus	Number of Species
Ash	*Fraxinus*	2
Basswood	*Tilia*	1
Buckeye	*Aesculus*	1
Cedar	*Juniperus*	1
Coffee tree	*Gymnocladus*	1
Cottonwood	*Populus*	1
Dogwood	*Cornus*	1
Elm	*Ulmus*	3
Hackberry	*Celtis*	1
Hawthorn	*Crataegus*	1
Hickory	*Carya*	6
Honey locust	*Gleditsia*	1
Ironwood	*Ostrya*	1
Locust	*Robinia*	1
Maple	*Acer*	4
Mulberry	*Morus*	1
Oak	*Quercus*	10
Osage Orange	*Maclura*	1
Paw Paw	*Asmina*	1
Persimmon	*Diospyros*	1
Plum	*Prunus*	3
Redbud	*Cercis*	1
Serviceberry	*Amelanchier*	1
Sycamore	*Platanus*	1
Walnut	*Jugluns*	2
Willow	*Salix*	5
	TOTAL	53

Source: Ref. (26)

TABLE B-2
SHRUB AND VINE GENERA AND NUMBER OF SPECIES COMMON TO THE KANSAS CITY METROPOLITAN REGION

Common Name	Genus	Number of Species
Berry	Rubrus	3
Bittersweet	Celastrus	1
Bladdernut	Staphylea	1
Buckbrush	Symphoricarpos	1
Buckthorn	Rhamnus	1
Cactus	Opuntia	1
Elderberry	Sambucus	1
False grape	Ampelopsis	1
Gooseberry	Ribes	1
Grape	Vitis	4
Greenbriar	Smilax	2
Hazelnut	Corylus	1
Indigo	Amorpha	2
Rose	Rosa	3
Sumac	Rhus	5
Trumpet creeper	Campsis	1
Virginia creeper	Parthenocissus	2
	TOTAL	31

Source: Ref. (26)

TABLE B-3
LIST OF MAMMALS IN THE KANSAS CITY METROPOLITAN REGION

Common Name	Genus	Species	Population Status	Habitat
Badger	*Taxidae*	*taxus*	C	mixed, open land
Bat, Big Brown	*Eptesicus*	*fuscus*	C	aerial
Eastern Pipistrelle	*Pipistrellus*	*subflavus*	R	aerial
Evening	*Nycticeius*	*humeralis*	R	aerial
Gray	*Myotis*	*griscescens*	U	aerial
Hoary	*Lasiurus*	*cinereus*	U	aerial
Indiana	*Myotis*	*sodalis*	E	aerial
Keen's	*Myotis*	*keeni*	U	aerial
Little Brown	*Myotis*	*lucifugus*	C	aerial
Red	*Lasiurus*	*borealis*	C	aerial
Silver-haired	*Lasionycteris*	*noctivagans*	U	aerial
Small-footed Myotis	*Myotis*	*subulatus*	U	aerial
Beaver	*Castor*	*canadensis*	C	aquatic
Bobcat	*Lynx*	*rufus*	R	mixed
Chipmunk, Eastern	*Tamias*	*striatus*	U	woods
Coyote	*Canis*	*latrans*	C	mixed
Deer, White-tailed	*Odocoileus*	*virginianus*	C	mixed
Fox, Gray	*Urocyon*	*cinereoargenteus*	U	woods
Red	*Vulpus*	*fulva*	C	woods
Gopher, Plains Pocket	*Geomys*	*bursarius*	C	open land
Lemming, Southern Bog	*Synaptomys*	*cooperi*	U	open land
Mink	*Mustela*	*vison*	C	aquatic
Mole, Eastern	*Scalopus*	*aquaticus*	C	mixed
Mouse, Hispid Pocket	*Perognathus*	*hispidus*	C	open land
House	*Mus*	*musculus*	C	buildings
Meadow Jumping	*Zapus*	*hudsonius*	C	edge land
Plains Harvest	*Reithrodontomys*	*montanus*	C	mixed
Western Harvest	*Reithrodontomys*	*megalotis*	C	open land

Table B-3 (Cont'd)

Common Name	Genus	Species	Population Status	Habitat
White-footed	Peromyscus	maniculatus	C	mixed
Wood	Peromyscus	leucopus	C	woods
Muskrat	Ondotra	zibethicus	C	aquatic
Opossum, Virginia	Diedelphis	virginiana	C	woods
Otter, River	Lutra	canadensis	E	aquatic
Rabbit, Black-tailed Jack	Lepus	californicus	C	open land
Eastern Cottontail	Sylvilagus	floridanus	C	mixed
Racoon	Procyon	lotor	C	woods, mixed
Rat, Eastern Wood	Neotoma	floridana	U	mixed
Hispidus Cotton	Sigmodon	hispidus	U	open land
Norway	Rattus	norvegicus	C	buildings
Shrew, Least	Cryptotis	parva	U	mixed
Short-tailed	Blarina	brevicauda	C	mixed
Skunk, Spotted	Spilogale	patorius	R	mixed
Striped	Memphitis	memphitis	C	mixed
Squirrel, Eastern Gray	Sciurus	carolinensis	C	heavy woods
Fox	Sciurus	niger	C	woods
Franklin's Ground	Citellus	franklinii	U	edge land
Southern Flying	Glaucomys	volans	C	heavy woods
Thirteen-lined Ground	Citellus	tridecemlineatus	C	open land
Vole, Prairie	Microtus	ochrogaster	C	mixed
Woodland	Microtus	pinetorum	U	woods
Woodchuck	Marmota	monax	C	mixed
Weasel, Long-tailed	Mustela	frenata	R	mixed

LEGEND

E - Endangered. Prospects for survival within the state are in immediate jeopardy; are protected by state and/or federal law.
C - Common. Regularly found in its habitat.
U - Uncommon. Irregularly found in small numbers in its habitat.
R - Rare. Rarely found, and generally only by an experienced observer.

Source: Ref. (26)

TABLE B-4
BIRD ORDERS AND NUMBER OF SPECIES SIGHTED IN THE KANSAS CITY METROPOLITAN REGION

Common Names	Orders	Number of Species
Bitterns, herons	Ciconiiformes	13
Comorants, pelicans	Pelecaniformes	2
Doves	Columbiformes	4
Ducks, geese, swans	Anseriformes	35
Falcons, hawks, vultures	Falconiformes	16
Grebes, loons	Graviiformes	7
Grouse, quail	Galliformes	3
Hummingbirds, swifts	Apodiformes	2
Kingfishers	Coraciiformes	1
Nighthawks	Caprimulgiformes	3
Owls	Strigiformes	9
Shore birds	Charadriiformes	49
Songbirds	Passeriformes	152
Woodpeckers	Piciformes	7
	TOTAL	303

Source: Ref. (26)

TABLE B-5
LIST OF AMPHIBIANS AND REPTILES IN THE KANSAS CITY METROPOLITAN REGION

Common Name	Genus	Species	Population Status	Habitat
Frogs:				
Blanchard's Cricket	Acris	crepitans	C	shore vegetation
Bullfrog	Rana	catesbeiana	C	permanent water bodies
Eastern Gray Tree	Hyla	versicolor	C	trees and shrubs
Green	Rana	clamitans	U	permanent pools, streams
Leopard	Rana	pipiens	C	mixed
Northern Crayfish	Rana	areolata	R	crayfish holes
Northern Spring Peeper	Hyla	crucifer	U	swamps, marshes
Pickerel	Rana	palustris	R	wet grassy meadows
Western Chorus	Pseudacris	triseriata	C	swamps, marshes
Lizards:				
Collared	Crotophytus	collaris	C	prairie rocks
Northern Fence	Sceloporous	undulatus	C	mixed
Western Slender Glass	Ophisaurus	attenuatus	C	moist woods and grass
Salamanders:				
Eastern Tiger	Ambystoma	tigrinum	C	mixed
Mudpuppy	Necturus	maculosus	U	streams and ponds
Small-mouthed	Ambystoma	texanum	C	moist soil
Spotted	Ambystoma	maculatum	C	deciduous woods
Skinks:				
Five-lined	Eumeces	fasciatus	C	woods
Great Plains	Eumeces	obsoletus	C	mixed
Ground	Lygosoma	laterale	C	woods
Northern Prairie	Eumeces	septentrionalis	C	grassy hillsides
Six-lined Racerunner	Cnemidophorus	sexlineatus	C	mixed

Table B-5 (Cont'd)

Common Name	Genus	Species	Population Status	Habitat
Snakes:				
Black Rat	*Elaphe*	*obsoleta*	C	trees and shrubs
Blotched Water	*Natrix*	*erythrogaster*	C	near water
Brown	*Storeia*	*dekayi*	R	mixed
Bullsnake	*Pituophis*	*catenifer*	C	prairies
Diamond-backed Water	*Natrix*	*rhombifera*	U	near water
Eastern Hog-nosed	*Heterodon*	*platyrhinos*	C	dry, sandy areas
Eastern Yellow-bellied Racer	*Coluber*	*constrictor*	C	mixed
Graham's Water	*Natrix*	*grahami*	C	water edges
Great Plains Rat	*Elaphe*	*guttata*	U	woods and edges
Northern Copperhead	*Agkistrodon*	*contortrix*	U	dry uplands
Northern Flat-headed	*Tantilla*	*gracilis*	U	rocky plains
Northern Lined	*Tropidoclonion*	*liniatum*	C	mixed
Northern Red-bellied	*Storeia*	*occipitomaculata*	U	woodlands
Northern Water	*Natrix*	*sipedon*	C	near water
Plains Garter	*Thamnophis*	*radix*	C	wet prairies
Prairie King	*Lampropeltis*	*calligaster*	C	prairies
Prairie Ringneck	*Diadophis*	*punctatus*	C	open woods
Red Milk	*Lampropeltis*	*doliata*	C	mixed
Red-sided Garter	*Thamnophis*	*sirtalis*	C	mixed
Rough Green	*Opheodrys*	*aestivus*	U	brush
Speckled King	*Lampropeltis*	*getulus*	C	mixed
Timber Rattlesnake	*Crotalus*	*horridus*	U	dry uplands
Westen Earth	*Virginia*	*valeriae*	U	pastures, woodlands
Western Hog-nosed	*Heterodon*	*nasicus*	R	dry, sandy areas
Western Massasauga	*Sistrurus*	*catenatus*	R	swamps, streams
Western Ribbon	*Thamnophis*	*sauritus*	C	water edges
Western Smooth Green	*Opheodrys*	*vernalis*	R	bogs and meadows
Western Worm	*Carphophis*	*amoenus*	C	moist woods

Table B-5 (Cont'd)

Common Name	Genus	Species	Population Status	Habitat
Toads:				
American	Bufo	americanus	C	wet woodlands
Great Plains	Bufo	cognatus	C	mixed grass prairies
Plains Narrow-mouthed	Gastrophryne	olivacea	R	woods
Plains Spadefoot	Scaphiopus	bomrifrons	C	sandy grasslands
Rocky Mountain	Bufo	woodhousii	C	mixed
Turtles:				
Common Snapping	Chelydra	serpentina	C	water
False Map	Graptemys	pseudogeographica	C	backwater streams
Map	Graptemys	geographica	U	permanent water
Mississippi Map	Graptemys	kohni	C	permanent water
Mississippi Mud	Kinosternon	subrubrum	U	ponds, ditches
Ornate Box	Terrapene	ornata	C	short-grass prairies
Red-eared	Pseudemys	scripta	U	quiet water
Smooth Soft-shelled	Trionyx	muticus	C	slow rivers
Stinkpot	Sternothaerus	odoratus	R	permanent water
Three-toed Box	Terrapene	carolina	U	mixed
Western Painted	Chrysemys	picta	C	quiet water
Western Spiny Soft-shelled	Trionyx	spinifer	C	slow rivers

LEGEND

C - Common. Regularly found in its habitat.
R - Rare. Rarely found, and generally only by an experienced observer.
U - Uncommon. Irregularly found in small numbers in its habitat.

Source: Ref. (26)

TABLE B-6
MILL CREEK: POOLED TAXONOMIC GROUPS AND NUMBERS OF INDIVIDUALS FROM ALL STATIONS AND ALL SAMPLE PERIODS, AND SHANNON-WIENER DIVERSITY INDEX

TAXONOMIC GROUPS	NOT FOUND IN CEDAR CREEK	NUMBER OF INDIVIDUALS
Baetis		1399
Caenis		34
Cheumatopsyche		758
Chironomidae		7983
Gyraulus circumstriatus	X	2
Hemerodromia		16
Hirudinea		21
Hyalella azteca		13
Hydroptila	X	1
Lirceus garmani		1
Micracantha	X	4
Oligochaeta		5019
Orconectes nais		19
Physa		99
Planaria		1
Psychoda	X	22
Simulium vittatum		10607
Sphaerium striatinum		8
Sphaerium transversum		49
Stenacron		141
Stenelmis		383
Stenonema tripunctatum		2
	Total Number of Individuals	26582
	Number of Taxa	22
	Shannon-Wiener Index	2.1064

Source: Ref. (24)

TABLE B-7
CEDAR CREEK: POOLED TAXONOMIC GROUPS AND NUMBERS OF INDIVIDUALS FROM ALL STATIONS AND ALL SAMPLE PERIODS, AND SHANNON-WIENER DIVERSITY INDEX

TAXONOMIC GROUPS	NOT FOUND IN MILL CREEK	NUMBER OF INDIVIDUALS
Allocapnia vivipara	X	135
Amnicola integra	X	2
Argia	X	16
Beatis		517
Berosus	X	1
Caenis		645
Ceraclea transversa	X	8
Chaoborus	X	1
Cheumatopsyche		823
Chimarra obscura	X	65
Chironomidae		8561
Ferrissia	X	1
Helisoma trivolva	X	2
Hemerodromia		21
Hirudinea		12
Hyalella azeteca		12
Hydropsyche simulans	X	4
Isoperla mohri	X	45
Lirceus garmani		25
Microvelia	X	12
Nematoda	X	1
Neoperla clymene	X	6
Oligochaeta		1100
Orconectes luteus	X	2
Orconectes nais		160
Perlesta placida	X	35
Physa		55
Planaria		113
Polycentropus	X	1
Rhagovelia	X	1
Ryacophila lobifera	X	3
Sialis	X	4
Simulium vittatum		1450
Sphaerium striatinum		9
Sphaerium transversum		37
Stenacron		454
Stenelmis		3285
Stenonema tripunctatum		228
	Total Number of Individuals	17852
	Number of Taxa	38
	Shannon-Wiener Index	2.6002

Source: Ref. (24)

TABLE B-8
CLASSIFICATION OF THE TOLERANCE OF VARIOUS MACROINVERTEBRATE TAXA TO ORGANIC WASTES:
TOLERANT (T), FACULTATIVE (F), AND INTOLERANT (I)

MILL CREEK:

Macroinvertebrate	T	F	I
Cheumatopsyche		758	
Hirudinea	21		
Hyalella azteca		13	
Lirceus garmani		1	
Oligochaeta	5,019		
Physa	99		
Planaria		1	
Psychoda	22		
Simulium vittatum		10,607	
Sphaerium striatinum		8	
Stenomema tripunctatum		2	
Percentage	31	69	0

CEDAR CREEK:

Macroinvertebrate	T	F	I
Allocapnia vivipara		135	
Amnicola integra			2
Argia		16	
Berosus	1		
Cheumatopshche		823	
Chimarra obscura			65
Ferrissia	1		
Helisoma trivolva	2		
Hirudinea	12		
Hyalella azteca		12	
Hydropsyche simulans			4
Isoperla mohri			45
Lirceus garmani		25	
Nemotoda		1	
Neoperla clymene		6	
Oligochaeta	1,100		
Perlesta placida		35	
Physa	55		
Planaria		113	
Polycentropus			1
Ryacophila lobifera			3
Sialis		4	
Simulium vittatum		1,450	
Sphaerium striatinum		9	
Stenonema tripunctatum		228	
Percentage	28	69	3

Source: Ref. (24)

TABLE B-9
NUMBER OF FISH COLLECTED IN MILL AND CEDAR CREEKS

SPECIES	NUMBER COLLECTED MILL CREEK	 CEDAR CREEK
Bluegill (*Lepomis macrochirus*)	22	-
Blunt-nosed minnow (*Pimephales notatus*)	-	31
Carp (*Cyprinus carpio*)	5	-
Channel catfish (*Ictalurus punctutus*)	34	35
Creek chub (*Semotilus atromaculatus*)	13	38
Fat-headed minnow (*Pinenphales promelas*)	1	-
Gizzard shad (*Dorosoma cepedianum*)	-	7
Golden shiner (*Notemigonus crysoleucas*)	19	-
Green sunfish (*Lepomis cyanellus*)	13	10
Johnny darter (*Etheostoma nigrum*)	-	1
Largemouth bass (*Micropterus salmoides*)	1	3
Logperch (*Percina caprodes*)	-	4
Longear (*Lepomis megalotis*)	-	1
Orange-spotted sunfish (*Lepomis humilis*)	4	-
Orange-throated darter (*Etheostoma spectabile*)	-	21
Plains minnow (*Hybognathus placitus*)	-	26
Red-finned shiner (*Notropis umbratilis*)	-	6
Red shiner (*Notropis lutrensis*)	17	170
River carpsucker (*Carpiodes carpio*)	9	11
Sand shiner (*Notropis stramineus*)	1	-
Slender madtom (*Noturus exilis*)	-	3
Stoneroller (*Campostoma anomalus*)	-	26
Sucker-mouthed minnow (*Phenacobius mirabilis*)	-	3
White sucker (*Catostomus commersoni*)	-	2
Yellow bullhead (*Ictalurus natalis*)	5	50
TOTAL INDIVIDUALS	144	448
TOTAL SPECIES	13	19

Source: Ref. (24)

TABLE B-10
COMMON AQUATIC PLANTS OF EASTERN KANSAS

Common Name	Scientific Name
American lotus	Nelumbo lutea
Baby Pondweed	Potamogeton pusillus
Bur-reed	Spargenium americanam
Cattail	Typha latifolia
Common Arrowhead	Sagittaria latifolia
Common Duckweed	Lemna minor
Coontail	Ceratophyllum demersum
Giant Duckweed	Spirodela polyrhiza
Horned Pondweed	Zannichellia palustris
Ironweed	Veronica fasciculata
Leafy Pondweed	Potamogeton foliosus
Southern Naiad	Najas guadalupensis
Water Willow	Justicia americana
Winter Scouring Rush	Equisetum hyemale

Source: Ref. (48)

TABLE B-11
FISH FOUND IN CEDAR AND OLATHE LAKES

Common Name	Scientific Name	Lake	
Bluegill	*Lepomis macrochirus*	C	O
Bullhead	*Ictalurus*	C	
Carp	*Cyprinus carpio*		O
Channel Catfish	*Ictalurus punctatus*	C	O
Crappie	*Pomoxis*	C	O
Green Sunfish	*Lepomis cyanellus*	C	O
Largemouth Bass	*Micropterus salmoides*	C	O
Sunfish	*Lepomis*	C	O
Walleye	*Stizostedion vitreum*	C	O
Warmouth Bass	*Lepomis gulosus*		O
White Bass	*Morone chrysops*		O

C = Cedar Lake
O = Olathe Lake

Source: Ref. (45)

TABLE B-12
1978 LICENSE SALES IN JOHNSON COUNTY

License	Sold	Value
Trap	115	$ 345.00
Combination	1,918	$ 19,180.00
Fishing	11,389	$ 56,945.00
Hunting	8,792	$ 43,960.00
Non-Resident Fishing	933	$ 9,330.00
Non-Resident Hunting	1,443	$ 36,075.00
Controlled Shooting Areas	-0-	$ 0.00
10-Day Trip	130	$ 650.00
	24,720	$166,485.00

Source: Kansas Fish and Game Commission

TABLE B-13
AGRICULTURAL PRODUCTION IN JOHNSON COUNTY, 1969

Product	Harvested Acres	Quantity
Corn	24,900	1,494,000 bushels
Wheat	14,000	434,000 bushels
Sorghum	13,500	918,000 bushels
Soybeans	14,800	370,000 bushels
Cattle	--	25,000 head
Hogs	--	14,000 head

Source: Ref (77)

APPENDIX C
WATER QUALITY DATA

Contents

Table No.

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C-2 Water Year - October, 1974 through September, 1975; Water Quality Data for Stations 1 and 6

C-3 Flow Data - Stations 1 and 6

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C-5 Water Quality Data for Stations 4 and 5

C-6 Water Quality Data for Stations 7 and 8

C-7 Water Quality Data for Stations 9 and 10

C-8 Mill Creek Water Quality at the Harold Street Plant Outfall

TABLE C-1
SAMPLING STATION LOCATIONS

Station Number	Collected by	Location Description
1	KDHE[a]	On Mill Creek at bridge on Highway 10 at Zarah, Kansas, river mile 3.4, several miles from the study area.
2	KU[b]	On Little Mill Creek near the confluence of Mill and Little Mill Creeks.
3	KU	On Mill Creek near 90th Street
4	KU	On Mill Creek near 95th Street
5	KU	On Mill Creek near 111th Street, about 2 miles downstream from the Harold Street wastewater treatment plant.
6	KDHE	On Cedar Creek at bridge on Highway 10, 4.5 miles east of DeSoto, at river mile 0.4, also several miles downstream from study area.
7	KU	On Cedar Creek about 1/2-mile south of Highway 10.
8	KU	On Cedar Creek at 107th Street, about 2 miles downstream from the confluence of Cedar and Little Cedar Creeks.
9	KU	On Little Cedar Creek at 119th Street, about 1-1/2 miles downstream of Leeview Estates wastewater treatment plant.
10	KU	On Cedar Creek at 127th Street, about 1-1/2 miles downstream of Olathe Lake.

[a] Kansas Department of Health and Environment
[b] University of Kansas
Source: Ref. (24, 39)

TABLE C-2
WATER YEAR - OCTOBER, 1974 THRU SEPTEMBER, 1975

WATER QUALITY DATA FOR STATION 1

	Cond. (umho)	Temp. (°C)	Turb. (JTU)	pH	TSS (mg/1)	Hard (mg/1)	Alk. (mg/1)	NO3 (mg/1)	NH3 (mg/1)	PO4 (mg/1)	DO (mg/1)	BOD5 (mg/1)	COD (mg/1)
Maximum	990.0	27	200.0	8.1	156.0	357.0	240.0	9.9	1.60	8.80	13.3	5.8	27.0
Minimum	450.0	0.0	6.0	7.6	17.0	192.0	136.0	3.5	0.28	1.00	4.9	0.8	12.0
Mean	658.3	12.4	42.4	7.8	52.8	271.0	190.1	5.8	0.64	3.45	8.9	2.4	17.9
Geom Mean	642.9	6.8	21.1	7.8	42.1	266.6	186.9	5.5	0.53	3.00	8.3	2.1	17.3
WATER QUALITY DATA FOR STATION 6													
Maximum	510.0	26.0	110.0	8.1	83.0	256.0	218.0	2.0	0.32	0.56	13.8	2.8	12.0
Minimum	470.0	0.0	6.0	7.9	10.0	212.0	196.0	0.3	0.16	0.24	4.7	0.4	7.0
Mean	490.0	12.0	58.2	8.0	48.7	235.0	203.5	1.3	0.23	0.36	9.3	1.3	9.0
Geom Mean	489.7	4.8	26.7	8.0	36.5	234.4	203.3	1.0	0.21	0.34	8.3	1.0	8.7

Source: Ref. (39)

TABLE C-3
FLOW DATA - STATIONS 1 AND 6

Date	Station 6 cfs	Station 1 cfs
10/15/74		6.30
11/12/74		8.00
12/17/74	3.30	8.00
2/11/75		7.30
3/12/75	2.30	7.30
4/8/75		9.60
5/13/75		5.90
6/10/75	54.2	6.50
7/15/75		4.70
8/12/75		3.10
9/2/75	3.20	3.70
11/14/75		5.50

Source: Ref. (39)

TABLE C-4
WATER QUALITY DATA FOR STATION 2

Date	Temp. (°C)	pH	DO (mg/l)	Turb. (JTU)	Cond. (umho)	Alk. (mg/l)	Hard (mg/l)	Total P (mg/l)	NH3 (mg/l)
12/29/77	2	7.4	12.3	14	476	284	340	N/A*	0.30
3/14/78	6	7.9	11.4	15	320	188	238	1.5	0.30
4/19/78	8	7.0	10.1	14	650	242	220	N/A	0.15
5/14/78	19	7.5	7.4	17	356	200	251	0.9	0.10
6/21/78	23	7.1	4.8	74	N/A	125	160	N/A	0.05
7/25/78	24	7.6	4.5	25	710	194	288	N/A	1.00
8/16/78	25	7.8	5.8	42	750	196	306	N/A	1.10

WATER QUALITY DATA FOR STATION 3

12/29/77	2	7.3	11.2	10	509	286	345	N/A	0.24
3/14/78	6	7.9	11.0	17	320	164	198	1.7	0.21
4/19/78	8	6.8	10.2	10	675	212	201	N/A	0.20
5/14/78	19	7.3	7.0	17	356	202	246	0.9	0.13
6/21/78	22	7.3	5.8	19	N/A	133	172	N/A	0.05
7/25/78	23	7.6	4.9	18	755	130	295	N/A	0.50
8/16/78	24	7.6	5.3	21	770	150	322	N/A	0.40

* Not Available

Source: Ref. (24)

TABLE C-5
WATER QUALITY DATA FOR STATION 4

Date	Temp. (°C)	pH	DO (mg/l)	Turb. (JTU)	Cond. (umho)	Alk. (mg/l)	Hard (mg/l)	Total P (mg/l)	NH3 (mg/l)
12/29/77	3	7.3	12.4	11	309	291	346	N/A*	0.19
3/14/78	4	8.0	11.8	12	208	176	230	0.4	0.05
4/19/78	9	7.3	11.0	5	500	206	233	N/A	0.21
5/14/78	18	7.5	7.8	14	171	174	212	0.8	0.05
6/21/78	22	8.9	4.4	22	N/A	166	220	N/A	0.06
7/25/78	23	7.6	4.1	16	405	233	299	N/A	0.05
8/16/78	22	7.6	4.4	17	480	224	301	N/A	0.15

WATER QUALITY DATA FOR STATION 5

12/29/77	5	7.4	10.8	18	582	286	333	N/A	3.60
3/14/78	5	7.6	9.4	20	362	164	202	3.1	2.60
4/19/78	8	7.0	9.8	18	675	210	205	N/A	2.40
5/14/78	18	7.4	7.0	15	392	209	227	1.7	5.10
6/21/78	20	7.1	4.8	7	N/A	205	356	N/A	3.30
7/25/78	22	7.4	2.9	4	825	136	301	N/A	9.60
8/16/78	22	7.5	3.7	9	880	150	314	N/A	10.80

* Not Available

Source: Ref. (24)

TABLE C-6
WATER QUALITY DATA FOR STATION 7

Date	Temp. (°C)	pH	DO (mg/l)	Turb. (JTU)	Cond. (umho)	Alk. (mg/l)	Hard (mg/l)	Total P (mg/l)	NH3 (mg/l)
12/29/77	2	7.2	12.0	14	210	293	366	N/A*	0.20
3/14/78	4	7.8	12.5	11	247	172	212	0.5	0.05
4/19/78	9	7.6	11.5	5	525	224	215	N/A	0.10
5/14/78	18	7.4	8.5	13	216	184	225	0.7	0.01
6/21/78	23	7.3	4.6	20	N/A	188	256	N/A	0.02
7/25/78	23	7.4	3.5	11	400	182	303	N/A	0.24
8/16/78	24	6.6	4.4	26	430	168	299	N/A	0.23

WATER QUALITY DATA FOR STATION 8

12/29/77	2	7.3	12.4	16	339	294	350	N/A	0.20
3/14/78	4	8.0	12.6	11	236	168	215	0.5	0.20
4/19/78	9	7.9	11.2	6	500	222	225	N/A	0.06
5/14/78	18	7.5	8.0	42	214	182	230	0.7	0.04
6/21/78	23	7.3	4.8	14	N/A	171	252	N/A	0.02
7/25/78	22	7.6	5.6	13	391	176	310	N/A	0.16
8/16/78	21	7.6	5.3	21	425	160	317	N/A	0.10

* Not Available

Source: Ref. (24)

TABLE C-7

WATER QUALITY DATA FOR STATION 9

Date	Temp. (°C)	pH	DO (mg/1)	Turb. (JTU)	Cond. (umho)	Alk. (mg/1)	Hard (mg/1)	Total P (mg/1)	NH3 (mg/1)
12/29/77	4	7.2	11.4	19	499	290	341	N/A*	0.25
3/14/78	4	8.1	11.8	12	312	176	222	0.4	0.06
4/19/78	9	7.3	11.7	6	575	218	227	N/A	0.10
5/14/78	18	7.5	8.2	90	240	191	247	0.4	0.03
6/21/78	21	8.4	4.8	11	N/A	164	212	N/A	0.02
7/25/78	19	7.3	4.9	4	575	260	304	N/A	0.03
8/16/78	21	7.6	4.0	18	625	250	309	N/A	0.00

WATER QUALITY FOR STATION 10

12/29/77	3	7.3	12.4	11	309	291	346	N/A	0.19
3/14/78	4	8.0	11.8	12	208	176	230	0.4	0.05
4/19/78	9	7.3	11.0	5	500	206	233	N/A	0.21
5/14/78	18	7.5	7.8	14	171	174	212	0.8	0.05
6/21/78	22	8.9	4.4	23	N/A	166	220	N/A	0.06
7/25/78	23	7.6	4.1	16	405	233	299	N/A	0.05
8/16/78	22	7.6	4.4	17	480	224	301	N/A	0.15

* Not Available

Source: Ref. (24)

TABLE C-8
MILL CREEK WATER QUALITY
AT THE HAROLD STREET PLANT OUTFALL

Date	Plant Discharge (MGD)	DO (mg/l)		BOD (mg/l)		TSS (mg/l)		pH		Sulfates (mg/l)	
		(1)Up-stream	(2)Down-stream	Up-stream	Down-stream	Up-stream	Down-stream	Up-stream	Down-stream	Up-stream	Down-stream
5-19-77	1.956	6.0	12.9	15.0	7.2	10.7	11.3	6.6	7.6	70	160
6-16-77	2.144	7.8	6.6	1.7	1.0	15.0	11.0	7.6	7.4	90	130
7-14-77	2.074	6.2	7.1	7.0	19.0	34.0	23.0	7.6	7.7	44	110
8-18-77	1.360	8.3	5.5	6.0	15.0	21.0	26.0	7.2	7.2	48	140
9-15-77	3.147	8.0	7.5	4.0	14.0	24.0	32.0	7.6	7.7	40	100
10-13-77	2.330	10.5	7.7	4.0	7.0	24.0	38.0	7.5	---	40	100
11-10-77	3.329	11.4	8.9	4.0	12.0	46.0	56.0	7.7	7.9	55	100
12-15-77	1.856	4.0	7.0	11.5	8.2	17.0	20.0	7.4	7.4	50	100
1-19-78	1.940	12.7	8.6	5.0	0	16.0	80.0	7.7	7.4	85	135
2-16-78	1.528	10.9	9.0	4.0	16.0	3.0	45.0	7.1	7.4	50	140
3-16-78	3.185	11.6	8.9	7.0	52.0	21.3	89.0	7.3	7.3	65	100
4-13-78	3.367	11.3	9.1	5.0	38.0	24.0	96.0	7.7	7.6	85	110
5-18-78	2.572	9.8	8.5	3.0	11.0	13.2	38.0	7.5	7.3	85	125
6-08-78	1.731	8.4	7.9	3.0	11.0	28.0	52.0	7.7	7.6	68	125
7-13-78	2.357	6.7	6.3	2.0	10.0	36.0	35.0	7.4	6.9	33	120
8-17-78	3.346	5.3	6.7	1.2	7.0	14.0	14.0	7.3	6.9	70	200
9-14-78	2.005	5.7	7.0	9.0	9.0	41.0	21.0	7.0	6.8	47	110
10-19-78	1.645	10.6	8.8	3.0	8.0	14.0	21.0	7.8	7.1	50	130
11-17-78	2.139	11.5	9.2	4.6	13.0	28.0	26.0	7.6	7.6	45	130
12-14-78	1.437	12.5	8.4	3.0	12.0	3.0	18.0	7.4	7.2	40	150

(1) Sampling location in stream about 200 feet upstream from plant discharge.
(2) Sampling location in stream about 1,600 feet downstream from plant discharge.

APPENDIX D
DATA ON EXISTING WASTEWATER FACILITIES

Contents

Table No.

D-1 Sewer Lengths and Sizes

D-2 NPDES Quarterly Reports for Harold Street Plant

D-3 NPDES Quarterly Reports for Leeview Estates Plant

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D-5 Sewage Treatment Plants on Mill Creek: Effluent Data

D-6 Extraneous Flow Basin Effluent Characteristics

TABLE D-1
SEWER LENGTHS AND SIZES

Watershed	Size, Inches	Length, Miles	Percent of Total	
			Watershed	Study Area
Upper Cedar Creek	8	1.8	86	2.0
	12	0.3	14	0.7
Subtotal		2.1	100	2.7
Little Cedar Creek	8	26.3	84	34.2
	10	0.5	2	0.6
	12	2.3	7	3.0
	15	1.4	5	1.8
	24	0.6	2	0.8
Subtotal		31.1	100	40.4
Mill Creek	8	36.4	83	47.4
	10	1.4	3	1.8
	12	3.4	8	4.4
	15	0.4	1	0.5
	18	0.4	1	0.5
	21	0.7	2	0.9
	24	1.1	2	1.4
Subtotal		43.8	100	56.9
TOTAL		77.0		100

Source: Ref. (9)

TABLE D-2
NPDES QUARTERLY REPORTS
FOR HAROLD STREET PLANT

Average Effluent Characteristics

Date From	To	Flow MGD	BOD_5 mg/l	TSS mg/l	Lead mg/l	Sulfates mg/l	*Fecal Coliform
NPDES Permit[b] Limits		----	30	30	---	---	200
2/1/76	4/30/76	1.60	27	34	N/A[a]	185	N/A
5/1/76	7/31/76	1.81	23	15	N/A	183	N/A
8/1/76	10/31/76	1.53	31	16	N/A	197	N/A
11/1/76	1/31/77	1.52	54	54	N/A	244	N/A
2/1/77	4/30/77	1.95	25	29	N/A	227	N/A
5/1/77	7/28/77	2.64	17	21	N/A	158	N/A
8/1/77	10/31/77	2.13	22	35	N/A	120	5,480
11/1/77	1/31/78	2.21	22	44	N/A	N/A	127
2/1/78	4/30/78	2.52	22	48	N/A	131	341
5/1/78	7/31/78	2.52	14	21	N/A	139	2,200
8/1/78	10/31/78	2.08	8	17	.1	159	41

---

* Organisms/100 ml

[a] Not Available

[b] Based on 1.5 mgd Flow

Source: Ref. (33)

TABLE D-3
NPDES QUARTERLY REPORTS FOR LEEVIEW ESTATES PLANT

Average Effluent Characteristics

Date From	To	Flow MGD	BOD_5 mg/l	TSS mg/l	*Fecal Coliform
NPDES Permit Limits		---	30	30	---
1/1/76	3/31/76	.015	96	70	N/A[a]
4/1/76	6/30/76	--	55	34	N/A
7/1/76	9/30/76	--	27	26	N/A
10/1/76	12/31/76	.015	17	20	N/A
1/6/77	3/24/77	.015	51	114	N/A
4/1/77	6/30/77	.015	24	17	N/A
7/1/77	9/30/77	.015	13	15	N/A
10/1/77	12/31/77	.0102	11	14	16,200
1/1/78	3/31/78	.015	14	23	26,400
4/1/78	6/30/78	.018	14	9	14,000
7/1/78	9/30/78	.011	11	8	2,800

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* Organisms/100 ml

[a] Not Available

Source: Ref. (33)

TABLE D-4
DELCO-REMY EFFLUENT CHARACTERISTICS[a]
1977

Parameter	Unit	Feb. 24	May 31	Sept. 6	Nov. 23
Flow*	(gpm)	600	600	600	600
BOD	(mg/l)	6.5	2.0	2.0	4.0
TSS	(mg/l)	4.2	9.0	11.0	6.0
pH		7.7	6.3	7.1	7.6
Oil & Grease	(mg/l)	6.8	2.0	28.0	12.0
Sulfate	(mg/l)	1920	1742	1050	1930
Suspended Lead	(mg/l)	0.0	0.266	0.382	0.100
Dissolved Lead	(mg/l)	0.607	0.490	0.338	0.081
COD	(mg/l)	84.6	2.7	20.0	17.0

City Ordinance Limitations:

Flow: 500,000 gpd, ave.; 1,000 gpm, max. instantaneous
TSS: 965 lbs/day, 3-day ave.; 1,250 lbs/day max.
Total Lead: 1 mg/l monthly ave.; 1.5 mg/l, weekly ave.; 2 mg/l, daily ave.
pH: 6.0-9.5

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* Discharged during one 8-hour shift.
[a] 24-hour composite grab samples

Source: Ref. (33)

TABLE D-5
SEWAGE TREATMENT PLANTS ON MILL CREEK: EFFLUENT DATA

Plant	Time Period	BOD_5 (avg.) mg/1	BOD_5 (max.) mg/1	TSS (avg.) mg/1	TSS (max.) mg/1	Flow MGD
1. Mill Creek Plant Johnson County	N/A*	5	N/A	11.5	N/A	0.15
2. Little Mill Creek North Johnson County	7/1/77 to 4/1/78	35	90	75	264	2.00
3. Lenexa Municipal Wastewater Treatment Plant	8/1/77 to 4/30/78	42	104	36.3	109	2.90

NOTE: NPDES Limitations for all three plants were 30 mg/1 avg. BOD_5, 30 mg/1 avg. TSS, and 200 fecal coliform colonies/100 ml at the time the data were collected. During 1980, all three plants' permits will be revised to 15/15/200.

* Not Available

Source: Ref. (24, 115)

TABLE D-6
EXTRANEOUS FLOW BASIN EFFLUENT CHARACTERISTICS

Date	Flow MGD	BOD mg/l	TSS mg/l	pH
11-3-77	1.200	32	29	7.4
3-09-78	0.148	N/A*	64	7.6
3-10-78	2.527	N/A	50	7.6
3-13-78	1.572	50	28	7.6
3-23-78	5.033	46	42	6.9
3-24-78	6.346	39	35	6.9
3-27-78	5.201	13	11	7.2
3-28-78	4.675	27	22	7.3
3-29-78	0.997	N/A	25	7.0
4-06-78	4.401	31	93	7.3
4-07-78	1.605	2	25	7.3
4-10-78	5.024	29	48	6.8
4-11-78	2.013	17	15	7.2
4-12-78	0.845	29	12	7.5
4-13-78	0.067	36	22	7.2

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* Not Available

Source: Ref. (33)

✡U.S. GOVERNMENT PRINTING OFFICE: 1980-669-062/21 REG.#6